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Principles of Jig and Fixture Practice

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The economics of jigs and fixtures reduced to a simple usable basis, and a statement of the general fundamental principles of design

THE combination of a machine tool and the jig or fixture which forms its work-holding equipment must do two things. It must drive a cutting tool of proper form and material in a motion which is exact as to path and often as to distance traveled. It must also hold the work in exact relation to the cutter. Precision in setting and holding the work is as important as precision and power in cutting. No amount of excellence in the machine is of use if the work-holding device is weak or inaccurate. In hand-tool production, where the operator directs and controls a free cutting tool, work holders are simple in character and of minor importance. Their only function is to hold the piece during some hand operation, a function easily met, as the cuts are light. In machine production the cuts are usually heavy, the thrusts severe, and, as the machine is controlling the cutting tool, there must be exact register between the work and the cutting tools.

How far it pays to go with jigs and fixtures cannot be determined on a basis of judgment. The author's formulas substitute a few simple calculations for most of this so-called "judgment," and typical examples show how the formulas are used

Jigs and fixtures did not assume importance until machine production came in. They are, therefore, comparatively modern; that is, not much more than 75 or 100 years old, and they have received their highest development in the United States. They are essential to the full use of modern production machine tools, and, together with limit and other types of gages, they form the basis of interchangeable manufacture. Of course, in recent years grinding has become an important element also, but interchangeable manufacture was well developed before precision grinding came into use.

The first real plunge into manufacturing with special tools and fixtures for practically every operation was made at the Colt Armory in 1853 and 1854, when Samuel Colt and E. K. Root, to the amazement of other manufacturers, spent as much for tools and fixtures as for the machines which were to use them. Despite the criticism aroused, the brilliant success of the plant justified the policy. The terms jig and fixture are often used interchangeably. In so far as they are differentiated, a fixture is a work-holding device, usually secured to the table of a machine, while a jig is usually free to center itself on the cutting tool. A fixture relies on the machine tool for accuracy of registry between the path of the cutter and the position of the work. In a jig the registry is largely self-contained. The term jig is most commonly used in connection with work-holding devices for drilling operations, although it, as well as the term fixture, is also used in connection with devices for babbitting, polishing, assembling, and welding.

Jigs and fixtures have been developed empirically and there is much less technical literature covering them than there is on power machinery and its utilization, or even on the very machines on which fixtures are used. Judging only from the literature available, one would gain no idea of their economic importance. However, the competitive technical advantage of one manufacturing plant over another will usually lie more in the better quality of its small tools, jigs, and fixtures than in differences between the types of machine tools in the respective plants.

The principles of good work-holder practice have grown up in the toolrooms, and been handed down from man to man. Due to the multiplicity and variety of articles manufactured, there is a great diversity of fixtures and holding devices, so great as to preclude treatment of all their details in a paper such as this. But through all fixtures there run certain principles which have been developed gradually and come to be recognized

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as good practice. Many of these principles can be brought together, and it is the purpose of this paper to do so.

The New Haven Machine Tool Exhibit and the Museum of the Peaceful Arts gathered a collection of work-holding devices which were shown at the tool exhibit in New Haven in September, 1927. Some of these are now in the Museum of Peaceful Arts, New York City, and it is hoped that this collection may be the nucleus of a more complete one which ultimately will show the development and principles of jigs and fixtures, and give an instructive and helpful picture of this important branch of shop practice. Such an exhibit, of course, can cover only physical features which can be embodied in actual examples. This paper aims to bring out not only the principles of design, but some of the intangible elements and economic principles which cannot be shown in an exhibit The first and most important element, which applies to all forms of work holders, is the economic one. A certain amount of "tooling up" is an advantage wherever parts are to be produced in quantity, but how far it should go and how much capital should be tied up in special fixtures and tools depends on immediate conditions. The question of the amount of expense justified has been handled largely on the basis of judgment. The besetting sin of the toolmaker is to tie up money in fixtures which may show a heavy saving when in use, but are seldom used. A saving of 5 per cent in labor cost on a job in constant use might justify greater expense in fixtures than a saving of 90 per cent on a small job coming through only once or twice a year. Other factors beside saving in time and labor expense are involved, such as the life of the fixtures, due not only to their own wear, but to possible obsolescence of the article they make. Fixtures *may* be desirable even where only small quantities are involved, but the economic advantage of lower labor costs is the controlling factor unless some other consideration, such as improved interchangeability, increased accuracy, or reduction of labor trouble, intervenes. Usually, where these latter reasons alone would have necessitated a fixture, it is found that the fixture lowers costs.

In the books available on work-holding devices are to be found methods of construction, much on the details, and examples of good practice in design, but almost nothing on the economics of the subject. Because of this lack, this aspect will be stressed here. It should be the first consideration, and is usually given little thought. Few plants give to their fixtures the searching economic analysis which they apply to their power equipment. Until recently, the same has been true for materials-handling equipment; but thanks to the Materials Handling Division of the A.S.M.E., formulas are now available, and are being increasingly used, which provide a standard basis for the economic analysis of equipment in that field, and for determining the probable profit on any proposed installation for given costs and performance. These formulas take into account interest, depreciation, obsolescence, and other items of overhead which theretofore had been either neglected entirely, or had been handled differently by every one concerned. They can be used, with modifications and simplifications, for tool equipment just as well as for materials-handling equipment, and should be.

The following is a suggested adaptation of them for this use. Certain factors in the materials-handling formulas which are important in installations in that field are of less importance in dealing with fixtures, or may drop out entirely. Others, such as the interest rate and taxes may be taken as constant and brought together. This permits simplification.

With fixtures, as with other types of equipment, depreciation is made up of two factors, deterioration and obsolescence. As a rule these do not bear equally. In one case deterioration, due to wear, may be the chief factor. More often, obsolescence, due to liability of change in models or design, may control. That one should be used which operates the faster. In dealing with fixtures, the economic problem centers on answering one or more of the following questions: 1. How many pieces must be run to pay for a fixture of given estimated cost, which will show a given estimated saving in direct-labor cost per piece? For instance, how low a run must we have to justify a fixture costing $400, which will save 3 cents on the direct-labor cost of each piece?

As a measuring stick for efficiency in fixture design, it is proposed that, in authorizing expenditures, an estimate be made of the cost and output of the fixture, and of the profit or saving from it, and that the results when the tool is put in operation be checked against these estimates

2. How much may a fixture cost which will show a given estimated unit saving in direct-labor cost on a given number of pieces? For instance, how much can we put into a fixture to "break even" on a run of 10,000 pieces, if the fixture can save 3 cents on the direct-labor cost of each piece?

3. How long will it take a proposed fixture, under given conditions, to pay for itself, carrying its fixed charges while so doing? For instance, how long will it take a fixture costing $400 to pay for itself if it saves 3 cents on the direct-labor cost per unit, production being at a given rate?

Questions 1, 2, and 3 assume that we just break even. There is also the following very practical question:

4. What will be the profit earned by a fixture, of a given cost, for an estimated unit saving in direct-labor cost and given output? For instance, what will be the profit on a $200 fixture if it will save, in direct-labor cost, 3 cents a piece on 10,900 pieces?

These questions involve something more than the simple arithmetic which seems all that is necessary for answering them, because, while the credit items for the fixtures depend mainly on the number of pieces machined, the debit items involve time, and also the number of set-ups required, i.e., whether the pieces are run off continuously or in a number of runs.

An important time element is, that many companies

now require that any new equipment shall pay for itself in a certain period. Investigations by the *American Machinist* [How Soon Should New Equipment Pay for Itself? pp. 853, 854, Vol. 65] and *Manufacturing Industries* [Jan., 1928, pp. 27-31] show wide variation in practice as to this requirement, ranging from one to six or seven years, the longer period being used by railroad shops which have a stable class of work not liable to rapid obsolescence. The general practice seems to be about two years, but conditions even within one shop might warrant lengthening or shortening this period for different specific cases.

The formulas reduce to the simple and workable forms found in equations 6, 7, 8 and 9 which follow, but to use them correctly it is necessary to have clearly in mind the meaning of the symbols used.

Let N = number of pieces *manufactured per year*

DEBIT FACTORS

A = yearly percentage allowance for interest on the initial investment. (If the interest be taken on the *depreciating* value, this becomes, under uniform depreciation for n years, $A \times \frac{1}{2}\frac{n+1}{n}$, the value of which decreases from A, for one year, and approaches $A/2$ as n grows large. For a life of two years this is $3A/4$, for three years it is $2A/3$. In the following formula either the original cost or the depreciating value can be used with equal facility. It is recommended, however, that one or the other basis be used uniformly to facilitate comparisons)

B = yearly percentage allowance for insurance, taxes, etc.

C = yearly percentage allowance for upkeep

$1/H$ = yearly percentage allowance for depreciation and obsolescence on the basis of uniform depreciation where H is the number of years required for amortization of investment out of earnings

E = yearly cost of power, supplies, etc., consumed, in dollars. (When the equipment under consideration is wholly new, this item appears in full. When it replaces old methods or equipment, the difference only is used. It is a debit if the E on the new equipment exceeds that on the old. It is a credit if the new E is less than the old. E in the formula may therefore be + or —.) In many cases, with fixtures this item is small and may be disregarded

I = estimated cost of the equipment or fixture i.e., cost installed and ready to run, including drafting and tool-room time, material and tool-room overhead, in dollars

K = unamortized value of the equipment displaced, less scrap value, in dollars. In the case of fixtures for new work, K drops out

$YCSU$ = yearly cost of set-ups, in dollars. This should include the time required for taking down the apparatus and putting machine into normal condition. In some plants, with departments large enough to employ several tool setters regularly, this time can be included in the department overhead; in which case this factor disappears as a separate item.

There are certain principles of fixture design which have been developed gradually, and have come to be recognized as good practice. The author brings together many of these principles. Those of a general and fundamental nature are presented in this part of the article

CREDIT FACTORS

S = yearly saving in direct cost of labor, in dollars
= N (old unit labor cost, minus the new unit labor cost)
= N (saving in unit labor cost)
= N ($SULC$) using initials as a mnemonic symbol. This covers *direct* unit labor cost only

T = yearly saving in labor burden, in dollars
= St (t is the percentage used on the labor saved)
= N ($SULC$) t
(Note: The latest form of the materials - handling formulas breaks this into T_a = burden on labor saved and T_b = burden on the equipment displaced. For use with fixtures the latter element may usually be disregarded for simplification.)

U = yearly saving or earning through increased production in dollars
= saving in unit labor cost × increased *yearly* production capacity
× the percentage of that increased capacity which will be utilized
× $(1 + t)$ (this cares for the burden saved)
+cost of extra old equipment which would be necessary to care for the increase
(Note: In many cases U may drop out)

V = yearly net operating profit, in excess of fixed charges, in dollars.

PROPOSED FORMULAS

If we just "break even" we have:
The yearly operating savings = total fixed charges per year. Using the above symbols, we have

$(S + T + U - E)$ — Yearly Cost of Set-Ups
$= I(A + B + C + 1/H) + KA$

Since $S + T = N(SULC) + N\ (SULC)t$
$= N\ (SULC)\ (1 + t)$

Then,

$$N\ (SULC)\ (1 + t) + U - E - (YCSU) = I\ (A + B + C + 1/H) + KA \quad (1)$$

To find the number of pieces required for a given cost I we have, solving for N,

$$N = \frac{I(A+B+C+1/H) + (YCSU) - U + E + KA}{(SULC)\ (1+t)} \quad (2)$$

To find the cost I which will just earn fixed charges we have, solving equation 1 for I,

$$I = \frac{N\ (SULC)\ (1+t) - (YCSU) + U - E - KA}{(A+B+C+1/H)} \quad (3)$$

To find the net operating profit over all fixed charges we have V = gross operating profit, less set-ups and fixed charges, or:

$$V = N\ (SULC)\ (1+t) - (YCSU) - I\ (A+B+C+1/H) + U - E - KA \quad (4)$$

To find the time H in years for the fixture to just pay for itself, the net profit V in equation 4 is equated to 0.

Therefore, setting the right-hand side of equation 4 equal to 0 and solving for H, we have

$$H = \frac{I}{N\ (SULC)\ (1+t) - (YCSU) - I(A+B+C) + U - E - KA} \quad (5)$$

In most cases it will be found that U, E, and KA may be neglected, so that equations 2, 3, 4, and 5, may be written as follows:

$$N = \frac{I\ (A+B+C+1/H) + (YCSU)}{(SULC)\ (1+t)} \quad (6)$$

$$I = \frac{N\ (SULC)\ (1+t) - (YCSU)}{(A+B+C+1/H)} \quad (7)$$

$$V = N\ (SULC)\ (1+t) - (YCSU) - I\ (A+B+C+1/H) \quad (8)$$

$$H = \frac{I}{N\ (SULC)\ (1+t) - (YCSU) - I\ (A+B+C)} \quad (9)$$

To be of practical value, the formulas should be as simple as possible and yet reflect the essential conditions, and should be easily applied. Equations 6, 7, 8, and 9 meet this condition for most fixtures. They take into account the number of pieces manufactured, the saving in unit labor cost, the overhead on the labor saved, the cost and frequency of set-ups, interest on investment, taxes, insurance, upkeep, and depreciation. The fuller formulas, equations 2, 3, 4, and 5, take into account, in addition to the above, the value of increased production capacity, cost of supplies and extra power, and interest on equipment displaced, if it is deemed that conditions require their consideration. These may be used for the more elaborate fixtures and for analyzing the purchase or building of machine tools.

In using the formulas, it must be remembered that N is the number of pieces manufactured in a *year*, not per run, except for the case of a single run of less than one year's duration.

The items A, B, and C, once settled upon, need change little. If the plant has the practice of requiring new equipment to pay for itself in a definite time H, say two years, the depreciation $1/H$ may be added to the other carrying charges, making a single percentage factor for the term $(A+B+C+1/H)$ which can be used until the management deems that changed conditions require modification.

To illustrate the economic analysis of a fixture by the use of these formulas, assume the following data:

Estimated unit saving in direct-labor cost		= 3 cents
Burden on labor saved		= 50 per cent
Estimated cost of each set-up		= $10.
A = 6 per cent	H	= 2 years
B = 4 per cent	$1/H$	= 50 per cent
C = 10 per cent	$A+B+C+1/H$	= 70 per cent

If I = $400, to find the number of pieces to be put through each year in one run per year, we have from equation 6

$$N = \frac{\$400 \times 0.70 + \$10}{\$0.03 \times 1.5} = 6{,}450 \text{ pieces}$$

That is, if a $400 fixture is to pay for itself in 2 years and carry overhead, with a single run per year 6,450 pieces must be put through each year.

If, instead, the pieces are put through in 6 runs per year, then

$$N = \frac{\$400 \times 0.70 + \$60}{\$0.045} = 7{,}550 \text{ pieces}$$

That is, more pieces must be run per year, due obviously to the increased number of set-ups.

There is, of course, a breaking point where it pays to have multiple runs, even at a higher production cost per piece, due to the balancing of production costs and fixed charges on increased inventory. Formulas are available elsewhere for determining this economic length of run.

Suppose the fixture is to pay for itself in a single run, how large must that run be?

In this case H is unity, as the fixture must pay for itself within the year, and $A + B + C + 1/H = 6 + 4 + 10 + 100 = 120$ per cent, then

$$N = \frac{\$400 \times 1.20 + \$10}{\$0.045} = 10{,}900 \text{ pieces}$$

This says that a smaller *total* output is required than when 6,450 pieces are called for, for *two* years, or 12,900, due to one less set-up and carrying the overhead for only one year instead of two.

It will be noted that this assumes the full-year values for A, B, and C. If the run is short and it is felt that this is too drastic, the values could be cut down in the proportion of the actual running time to one year. It would be safer and, therefore, good practice to use the yearly rates, as the time for the complete turnover of the money going into the fixture is hard to determine and certainly is longer than the mere run itself. The cost of short-lived equipment should be extinguished as soon as possible.

Reversing the above assumptions, how much money could we put into a fixture for a single run of 10,900 pieces at an estimated saving of 3 cents per piece? From equation 7,

$$I = \frac{10{,}900 \times \$0.045 - \$10}{1.20} = \$400$$

Similarly, if we want 7,550 pieces a year in six runs per year, and want the fixture to pay for itself in two years, we have from equation 7,

$$I = \frac{7{,}550 \times \$0.045 - \$60}{0.70} = \$400 \quad (10)$$

If we want to know the reverse of this, namely how long a time it would take a $400 fixture to pay for itself, we have from equation 9,

$$H = \frac{\$400}{7{,}550 \times \$0.045 - \$60 - \$400 \times 0.20} = 2 \text{ years}$$

From equation 10 we see that we would "break even" with a cost of $400. Suppose now, we can design a fixture for the same conditions which would cost $250 instead of $400, what will be the *profit?* Using equation 8 we have, for 7,550 pieces per year in six runs per year,

$V = 7{,}550 \times \$0.045 - \$60 - \$250 \times 0.70 = \$105$ per year. For a *single* run of 10,900 pieces, the profit would be

$V = 10{,}900 \times \$0.045 - \$10 - \$250 \times 1.20 = \$180.50$

Formulas 3 and 7 may be used to help in deciding between two fixtures of different degrees of refinement for the same job. For instance: For a single run of 2,000 pieces, under the above conditions, how much can we afford to put

(*a*) Into a fixture, if it will save 3 cents per unit, with a set-up cost of $10, or

(*b*) Into a more refined fixture which will save 5 cents per unit, with a set-up cost of $15?

We have from equation 7,

$$\text{For (a) } I_a = \frac{2{,}000 \times \$0.03 \times 1.5 - \$10}{1.20} = \$66.66$$

$$\text{For (b) } I_b = \frac{2{,}000 \times \$0.05 \times 1.5 - \$15}{1.20} = \$112.50$$

Obviously also, the same formula may be used to compare the amounts which might be put into fixtures for different lengths of run.

The above examples show how the formulas proposed may help in deciding tooling-up problems as they arise. They apply not only to jigs and fixtures, but to punches and dies, special tool equipment and, in the fuller forms, to proposed machine tools.

It is recommended that in authorizing expenditures for all fixtures and tools, above some minimum cost which could be set, an estimate be made of the

(*a*) Cost of the fixture
(*b*) Output of the fixture
(*c*) Profit or saving from it.

Also, that when it is put into operation the results be checked with these estimates.

Such a procedure would give a check on the quality of the tool designing. If tool costs are over-running the estimates and the output and savings falling short, the facts will be shown up. If the tool work is good the management will know it, and have means for measuring the profit therefrom.

Certain General Principles

Before a set of fixtures can be designed, the dimensions of the article to be manufactured must be definitely determined. This means that clearances and allowances must be made on certain dimensions for running, sliding, or driving fits. Furthermore, the tolerances, or permissible deviations, must be established. These tolerances set the high and low limits for each dimension, which can not be exceeded without encroaching on the allowances necessary for proper functioning or destroying the interchangeability of the parts. In general, the smaller the tolerances the greater the cost of production, consequently they should be as liberal as is consistent with the requirements of the product, and accuracy should be centered on those dimensions on which it is essential. The closeness of the tolerances governs the design and workmanship of the jig or fixture quite as much as the required rate of production.

When the drawings of the article to be manufactured have been checked and approved a model should be made to within the tolerances given on the drawings. When this has been tested and pronounced satisfactory, any changes found necessary in allowances, tolerances, etc., should be incorporated into the drawings. The model and drawings can then be used as the basis for design of the jigs and fixtures. If, during the building of the tools, any discrepancy should develop between the model and the drawings, the approved working model should govern, and the drawings be corrected to agree with it. When actual model parts are not available, wooden models of such parts as drop-forgings, with the location of the sprue and flash line painted on them, may be helpful.

In tooling up for the manufacture of a piece, an operation sheet should be prepared which includes every operation on the piece, both of production and of inspection or gaging, showing them *in a single list* in the order of their application. The preparation of such a list focuses attention not only on the best sequence of production operations, but on the number of inspections needed, the dimensions they should cover, and the best points in the sequence at which they should occur. It also brings out the best grouping of operations, and their reduction to the least possible number.

One authority consulted contributes the following as the procedure used by one large manufacturer having agencies throughout the world. "When a new machine has been developed to a stage where it functions satisfactorily, the agencies are informed, and inquiries are instituted to determine the probable sales for the machine. During this inquiry period the machine is going through a process of refinement. Drop forgings, stampings, grades of metal, hardness and finishes are being determined. When the approximate yearly sales have been determined, manufacture starts by ordering all drop-forgings, blanking and bending dies, as these take the longest time to construct. Parts which are odd in shape or difficult to hold are assigned for tooling up, starting in the usual manner, with operation sheets which are provisional, as it is often necessary to revise the sequence of operations. Quality and interchangeability are the main requirements. While quantity will influence the type of fixtures, it is possible to make cheaper tools at first with provision for the future if unexpected sales should develop."

The fixtures should be tied in with the system of gaging. The same points or surfaces should be used for locating the work in the fixtures, and for reference points in the gages. Only by so doing are the gages a direct check on the fixtures. Some deviation is made, however, as when inspection gages are made to cover a subassembly of parts in order to insure that certain collective deviations do not exceed permissible tolerances. In some cases, also, as with pistons, it may be desirable to provide lugs especially for holding and driving during manufacture, which are removed in the last operation.

The same working points should be used on the two parts which go together in the manufactured output. This better insures interchangeability of the product.

In selecting the working points, the functioning of the product and those dimensions which are most important to its operation should be given most careful thought.

It is of fundamental importance that, once settled upon, the same working or locating points be used for as many operations and gagings as possible. Preferably, they should be permanent and remain in the piece when finished. If this can not be done they should be retained as long as may be. If first one point and then another be used, an accumulation of errors creeps in which may exceed the tolerances. It is tempting at times to shift

the locating point, as the fixture and gage might then be made more cheaply, but to do so is poor practice, and in the long run, poor economy. As an example of the above, in a set of fixtures recently built for a military rifle, 62 out of 67 operations on one piece, with their gagings, were located from one point.

It *may* be wise to shift the reference point, but it should be done only for good and sufficient reasons. For instance, the position of two holes *A* may be referred to a main reference point. The important requirement of a second hole *B* may be exact distance from holes *A* without regard to the original reference point. In such case both the fixture and the gage would very properly locate *B* with reference to the holes *A*.

If a multiple fixture is to be used, of either the reciprocating or indexing type, the question of the time required for removing and inserting pieces is of fundamental importance, as the clamping means must be so designed that the pieces can be handled in the time taken for the cut.

In general it is desirable to machine as many surfaces, or drill as many holes, as possible at one setting. This makes for accuracy, lessens tool expense, and cheapens production, but is subject to some limitations, as for instance, the combination of a very large and very small hole in the same jig. It may be better to use two jigs on different sized machines. In some cases, all the holes can be drilled in the same jig on one machine, and the larger holes then redrilled on another machine without a jig. This eliminates the cost of one jig.

In using a fixture equipped so that several tools perform the same operation on several pieces simultaneously, the parts from each tool should be kept separate. By so doing, if the product from one tool is defective, the parts will not become mixed and the trouble is more easily located and remedied. However, the additional cost of handling the parts separately may sometimes more than offset the advantage of easily locating trouble.

How far it is desirable to make a fixture adaptable to various pieces and operations is a matter of judgment in each case. It usually does not pay except where the runs are very small. In general, specialization is better than adaptability, because the latter, while it lessens tool expense, permits errors in settings and "monkeying" with the set-up.

On the other hand, the Western Electric Co., wherever possible, designs jigs and fixtures for more than one part, and reports that the practice has given little trouble and resulted in large savings in tool expense. Errors in use have been avoided by providing wear plates which can be so located as to cover up the holes not required for the part being drilled. These plates and the jig are stamped to indicate the position of the plates for each part, so that they can be located without difficulty.

Fixtures should be interchangeable on the various machine tools on which they can be used. Care in this particular allows greater flexibility in scheduling work through the shop. This principle calls for the standardization of slots on milling machines, machine tables, and of keys and keyways on the fixtures. So far as possible these should conform to the standards adopted by the American Engineering Standards Committee, and sponsored by such bodies as the A.S.M.E., the National Machine Tool Builders' Association, and others.

The following standards applicable in this connection have been adopted by the A.E.S.C.:

"Square and Flat Stock Keys," AESC-B17b-1925

"Plain Taper Stock Keys, Square and Flat," AESC-B17d-1927

"Gib Head Taper Stock Keys, Square and Flat." AESC-B17a-1927

"T-Slots, Their Bolts, Nuts, Tongues, and Cutters," AESC-B5a-1927.

All jigs and fixtures should be clearly marked, preferably by stamping *into* the body where it can be done, the operation, part number, etc., for which it is intended, and any other information needed to identify it, also on all loose or bolted parts that may be separated from it. In very accurate fixtures stamping might be harmful. In such cases a brass plate should be screwed on, or the necessary marking may be etched.

Mr. Hutchinson, of the Western Electric Co., contributes the following: "It is not our practice to stamp tools used in the general manufacturing departments with the part number for which they are to be used. All tools are stamped with the tool number which is the same as the number of the drawing for the tool, and which is assigned consecutively from the block of numbers specified for tools. The tool number is specified on the manufacturing layout or operation sheet for the piece part made with the tool, and its use is identified in this way. A considerable number of our tools, especially those for general use, are used for a number of different parts, and it would be impractical to stamp all the part numbers on the tools, especially as there would be no definite number by which the tool could be identified. Also these parts change rather often with new ones added and others omitted, and this would mean restamping the tools, while if a specific number is assigned to the tool it is only necessary to specify this number on the layout of the new part. The only tools on which we follow the plan mentioned in the paper are some of those used in the jobbing or specialty-products department, which are usually made without drawings and are more or less temporary for parts on a customer's order basis or not made in sufficient quantities to warrant preparing manufacturing layouts or running in the regular shop departments. For a small shop where only a few tools are required, the plan of stamping the part number would probably be satisfactory."

All small parts, such as clamps, special wrenches, etc., should preferably be permanently attached to the jig or fixture to prevent their being mislaid or lost.

Despite the wide variety in jigs and fixtures, many details may be standardized such as bushings, feet, latches, handles, thumbscrews, etc. This lowers costs not only by making approach to quantity production possible in the tool room, but by making it possible to purchase them from firms specializing in such parts. It is amazing in going through large tool storages to see how many types of handles, etc., there are, differing from each other in unessential details in ways which run up costs without any compensating benefit.

The object of good fixtures is furthered by good work holders or racks for handling the work between operations. Throwing work promiscuously into tote boxes mars the finished surfaces and may cause misalignment in locating in succeeding operations.

A jig or fixture should:

(*a*) Locate the work quickly and positively

(*b*) Preclude insertion of the work in any but the position correct for cutting

(*c*) Provide rapid and positive clamping without undue effort

(*d*) Allow no spring in the work, fixture, or machine table from either clamping or the pressure of the cutting tools

(*e*) Allow no slipping, vibration, or chatter during the cut

(*f*) Have ample clearance for chips, and be easily cleaned

(*g*) Allow free access and egress for cutting oil or compounds

(*h*) Be as light as is consistent with strength and rigidity, and easy to handle. In the long run the employer always pays for weariness, necessary and unnecessary.

(*i*) Be safe for the operator. Production should be sacrificed, if necessary, rather than have a tool which is dangerous.

Inspection Methods *and Their Application*

By Fred H. Colvin
Editor, American Machinist

Flywheel balancing and inspection—Checking clutch spring tension—Inspecting bearing shells and testing lifter-guide holes for squareness

PRACTICE as to balancing flywheels varies considerably in different plants. In some shops the flywheel is balanced statically and receives its dynamic balance after it is assembled on the crankshaft. At the Oakland plant, however, the flywheels are balanced dynamically before being attached to the crankshaft, on a Defiance vertical-spindle balancing machine, as shown in Fig. 184. This machine has a spindle on which the flywheel is mounted and revolved at a high speed. The spindle is so arranged that it is free to move under the stresses of an unbalanced flywheel, the amount of movement being noted on indicators provided for the purpose. They show any out of balance of the flywheel, and allow correction to be made before it is attached to the crankshaft.

The Olsen machine, Fig. 185, is used in the Hupp plant for balancing flywheels before mounting them on the crankshafts. It indicates the point at which metal should be removed and shows how much is to be drilled out. After balancing, the flywheels go down the conveyor line to the two testing fixtures shown in Figs. 186 and 187, where concentricity, squareness of face and the meshing of the starter gears are tested. A closer view of the latter fixture is shown in Fig. 187, to illustrate the construction of the fixture and the way in which the gages are applied. The dial indicator at the left shows the variations in tooth contact as the gears are revolved. A similar method is used at the Chrysler plant, although the construction of the testing fixture is somewhat different, as will be seen in Fig. 188. The inspection is done near the gear cutting department, and the conveyor line serves both. The dial indicator checks the face of the flywheel only. Among the inspection tests for the flywheel of the Franklin engine, is that for checking the concentricity and trueness of face of the portion that carries the clutch. A test bar *A*, Fig. 189, is placed in the central hole, and the arm *B* is slipped over the end. This arm is of aluminum and is provided with a steel bushing, where it fits the test bar. By swinging the arm around on the test bar, the two indicators show any variation either in the bore or the face of the projection that forms the clutch case. This inspection is to insure the clutch being located both concentric and square with the flywheel.

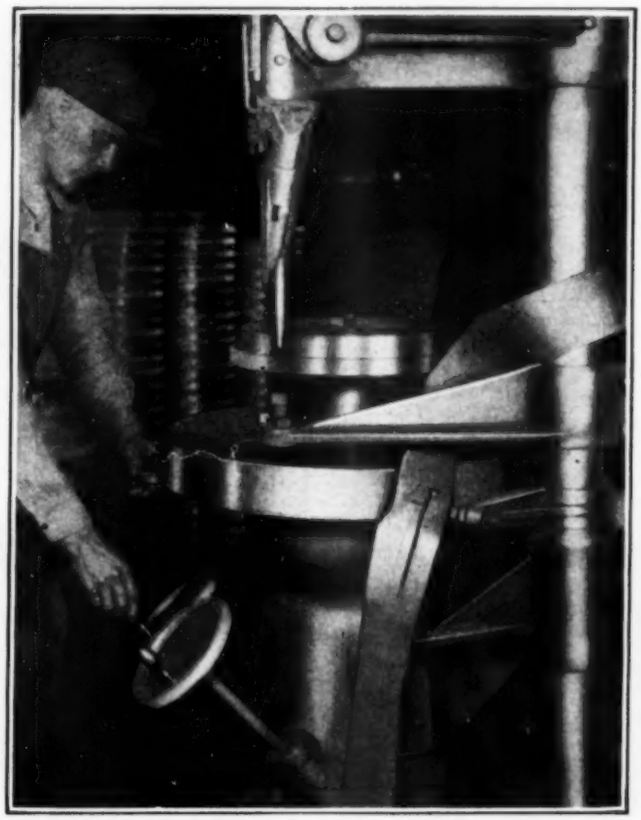


Fig. 184 — Flywheel balance is necessary if the engine is to run smoothly and without vibration. The Oakland flywheel is tested and balanced on this vertical machine

Two methods of testing the action of the clutch are shown in Figs 190 and 191. Fig. 190 shows the clutch in place in a testing fixture, where it is held by quick-acting clamps in front. Then the upper portion *A* is swung around the pin *B* until the pin *C* rests in the half-bearings shown. This brings the testing finger *D* under the collar of the clutch and enables the inspector to feel the action of the clutch spring by means of the lever *E*. Bar *H* with its splined end, is placed in the end of the clutch opening, and the inspector can easily determine whether or not the clutch disk is perfectly free when the clutch is in the released position. The next inspection is for the pressure required to release the springs in the clutch. Here the clutch is placed on the floating platform at *A*, Fig. 191. The crossbar *B* is pinned to the upright and carries the plunger *C*, which is operated by the handwheel *D*. The floating platform *A* is suspended from the crosshead *E*, which is attached to the lower side of the large spring-balance shown. Turning the handwheel *D* forces down the plunger *C* and compresses the clutch springs

The twelfth and concluding article.

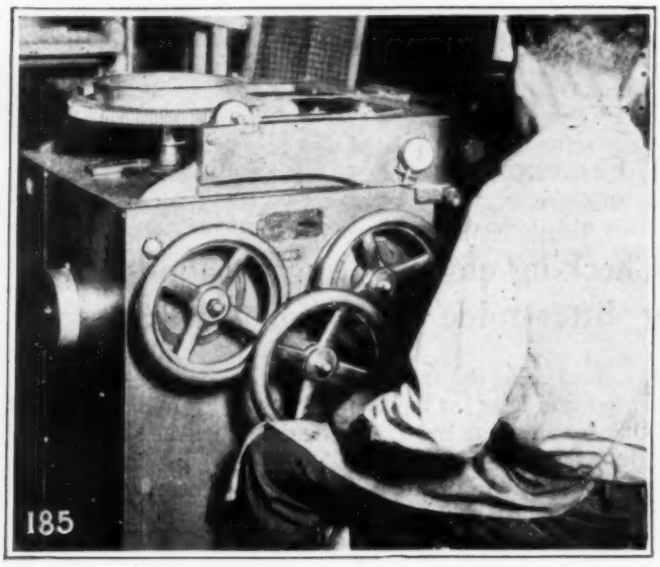


Fig. 185—Flywheel balancing machine for showing the "run-out" of wheel due to uneven distribution of metal. The machine shows where and how much metal is to be removed. This helps to insure a smooth running engine. Fig. 186—Fixture for testing concentricity of flywheel and meshing of starting gear. The arm at the left with the two dial gages checks the accuracy of the diameter and the face of the clutch housing

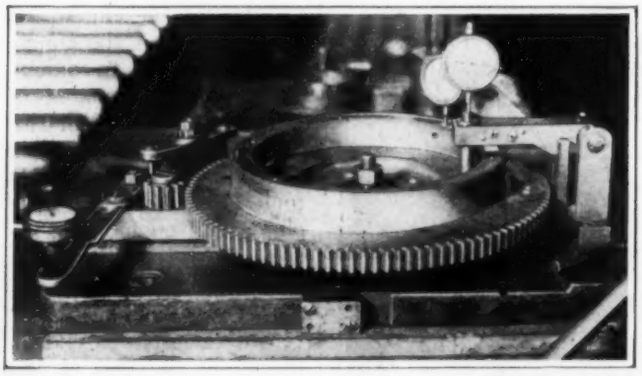


Fig. 187—Close view of the fixture in Fig. 186. The gage at the end of the starting pinion slide shows the eccentricity of the gear cut on the flywheel rim. This view also shows the construction of the fixture

while forcing the floating platform *A* downward against the resistance of the spring balance.

When the springs have been compressed the proper amount, the floating platform makes contact in the electric circuit, and the lamp *H* lights. At the same time, the inspector notes the position of the pointer on the spring balance and knows at once whether or not the clutch springs are of the proper tension. The flashing of the light at the proper point makes it easy to take the reading of the spring balance.

It is Chrysler practice to use the Chadwick standard bearing-shells. These shells are used interchangeably in the crankcase so that it is necessary to know that each shell is right as to fitting both the bearing seat and the crankshaft. To check these dimensions the half shell is laid in the base that represents the crankcase bearing seat in which it is seated by pressure from the counterweight, as in Fig. 192. The rear stop *A* is fixed and the weight of *B*, bearing on the front edge of the shell, forces it up against the stop and also seats it in the same manner as when it is in the motor. The indicator shows any variation from standard size.

A very interesting method of checking the squareness of holes in valve lifter guides is shown in Fig. 193. The

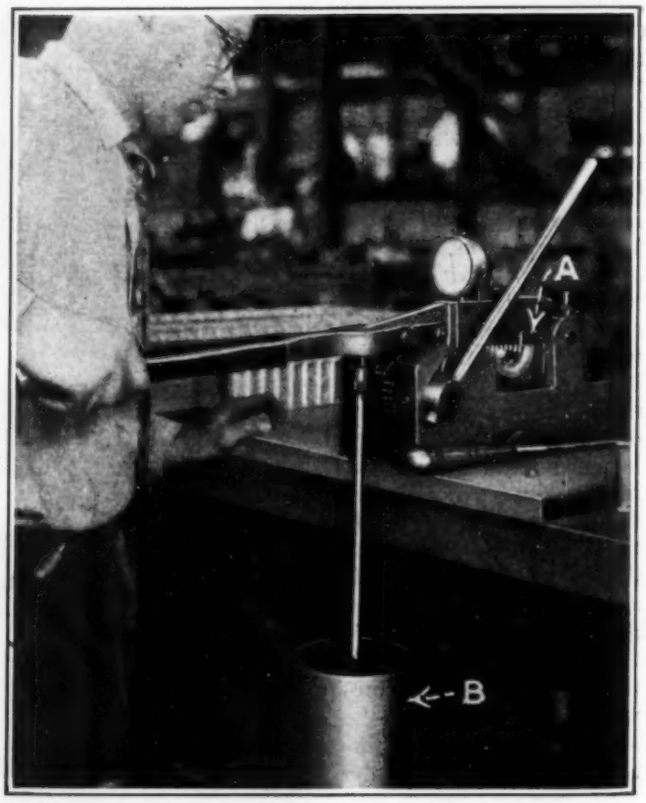


Fig. 192—Method of checking the accuracy of the bearing shells used in Chrysler motors. One edge of the shell is forced against a solid stop and the height of the other side is checked by the dial gage shown

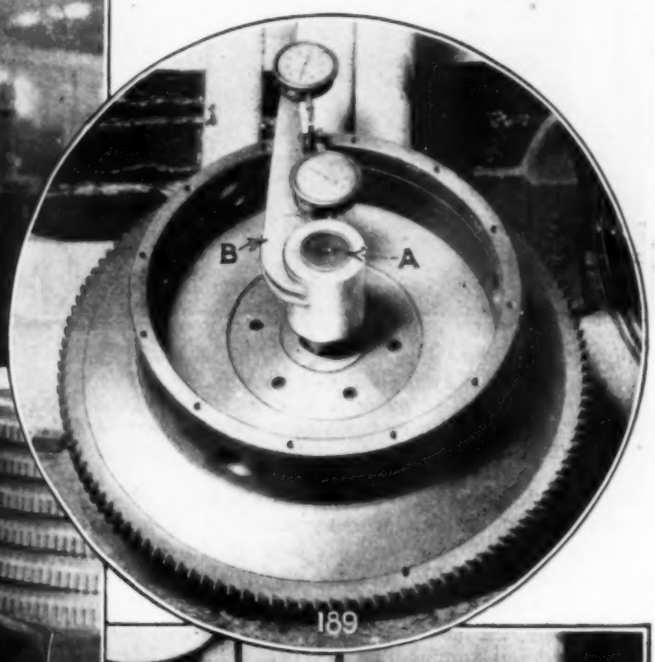


Fig. 188 — Another fixture for checking accuracy of flywheels. Here, owing to its construction, the face only of the flywheel is tested

Fig. 189 — Checking the clutch chamber in the Franklin flywheel. The aluminum arm has a steel bushing and by swinging it on the central post the concentricity and face of the wheel can be easily checked

Fig. 190—Testing fixture for the complete Franklin clutch unit. The clutch is clamped by the cams shown

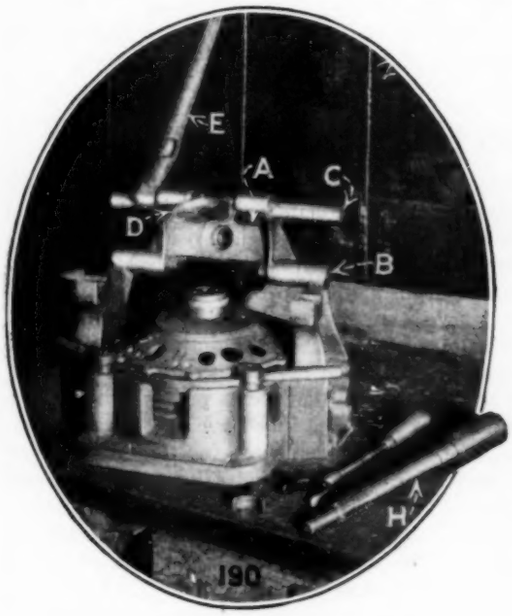
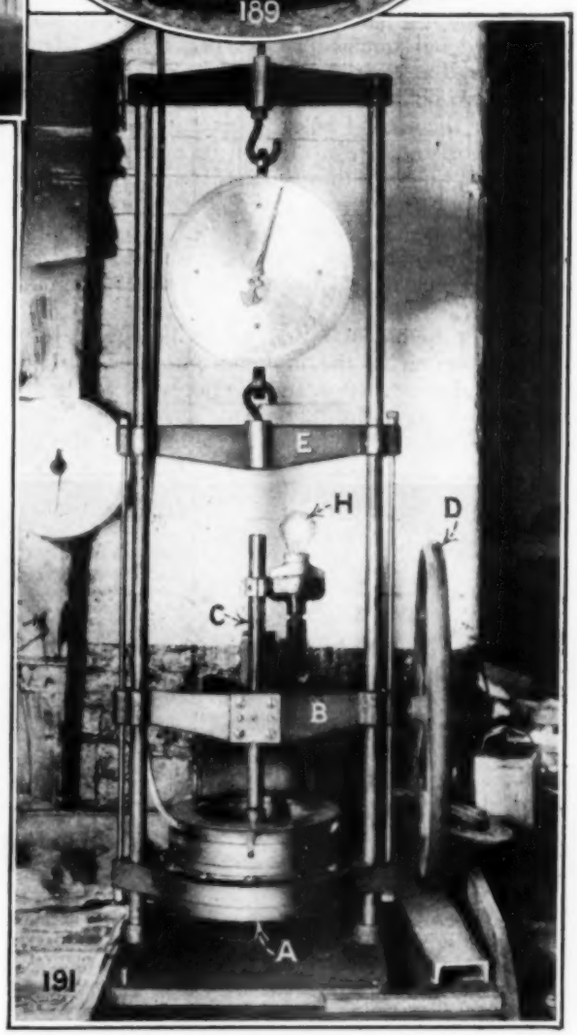


Fig. 191 — Another Franklin device for weighing the action of the clutch springs. The clutch "floats" on the two side rods and should the springs require undue pressure to operate, the lamp lights and informs the inspector



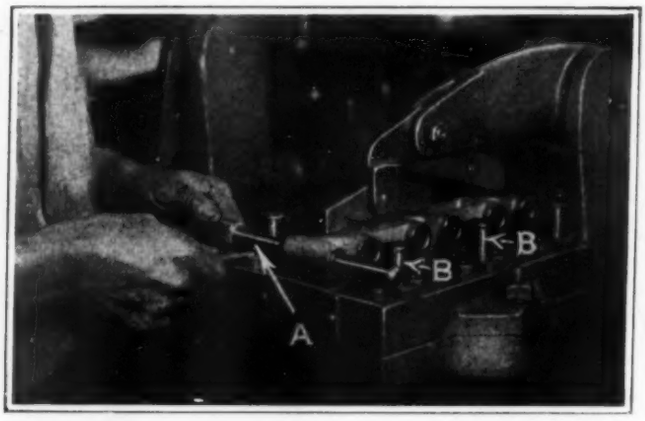


Fig. 193—Fixture for checking the alignment of valve-lifter guide holes by the use of a thick feeler and suitable gaging points. The guide is held at three points by a double floating lever and gaging points are provided to check the holes in both directions

guide carries six valve lifters which must be at right angles to the flat surfaces by which it is held to the cylinder block. The guide is held at the three bolting surfaces by a double floating clamp that equalizes the pressure at the three points. With the guide clamped in position the test bar *A* is put in each hole and parallelism is checked by standard feelers between the bar and the test plugs *B* at each end of the bar. The test plugs each act for two holes, the test bar going the other side of the plugs for the second hole. There are six pairs of plugs for the horizontal test. It will be noted that the feelers are not of the very thin type so frequently used, but are thick enough to prevent any tendency to buckle or bend while in use. Needless to say a gaging fixture with twenty-four gaging surfaces, as in this case, must be very accurately made to insure the proper alignment of each hole.

Another item that is not apt to be considered by the casual observer is the brake drums. The advances in design and construction and the necessity for better braking control have brought many changes in design and material. Ribs for dissipating the heat are also common.

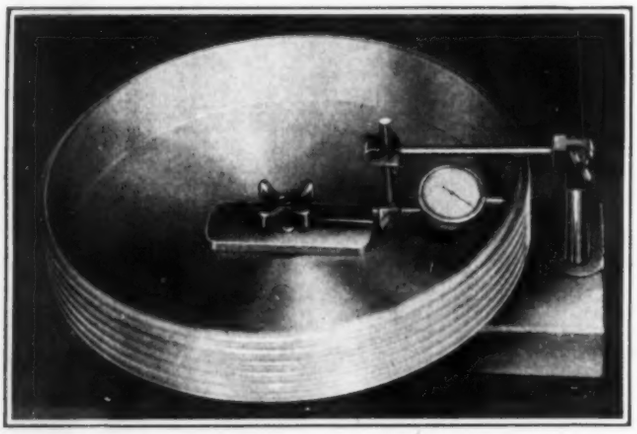


Fig. 194—Brake drums are so important in modern motoring that great care is taken to have them present a true surface to the brake shoes. The dial indicator swings down on the arm shown and can be readily removed after testing. The mounting is flexible in every way

The Pierce-Arrow brake drum is made from a heavy steel forging and is finished all over. Before being mounted on the wheel, its concentricity is checked by the gage shown in Fig. 194. The arm carrying the gage can be easily swung in or out of position and locked by the thumb nut shown. The drum fits over a revolving center and is quickly clamped by the slotted washer shown. It is easily revolved, and the concentricity can be checked very rapidly.

Reducing Spoilage by Proper Instruction—*Discussion*

By Frank C. Hudson

I AGREE with John B. Sladen that more instruction is necessary to reduce spoiled work, as pointed out in the editorial on page 632, Vol. 69. I am not, however, so sure that the foreman is always the right man to be the instructor, even if he has the time, and few of them have, especially in a high production shop.

Instructors seem to be born rather than made, although I am not saying they cannot be made. Some of the best executives may be poor instructors. Many have not the capacity for teaching even though they can do the job perfectly themselves. The ability to impart knowledge, and particularly to make it interesting, is a gift that should demand higher remuneration than it generally receives.

The foreman's first job is to get out the work as fast as needed. Few of them can spend the time necessary to instruct boys or men as they should be instructed. And perhaps even fewer know how to do the best kind of a job at teaching.

I am inclined to believe that there should be one or more instructors, working in co-operation with the foreman, but relieving the foreman of all but his executive duties. Men who have a flair for teaching can not only show the average man how to do a good job, but can make him take pride in it, and keep him interested in his work. Such a man is worth more to the firm, and to the community, than he is likely to receive. I believe the instructor should have as important a place in the shop now as he did during the war.

Proper Flux Essential in Welding

THE selection of a proper flux has a very profound effect upon the ultimate qualities of a weld. It is almost needless to say that a flux should be used only in welding the metal for which it was particularly prepared. The chemical reactions which must be set up, for instance, to weld sheet brass successfully, are entirely different from the reactions between an aluminum and its flux. It must follow therefore that brass flux will be unsuitable for welding aluminum, and that welds made with such an unsuitable flux could not possibly have proper strength.

In general, the homely substitutes for the correct flux often used, such as salt, borax and other materials and combinations, are to be avoided. They are beneficial in some cases, but in others they may be actually prejudical to the success of the weld. It is much safer to use a correctly prepared commercial flux.

Preventing Unfair Rejections?

THE Milltown Products Company was in a jam. It had been making parts for a motor company for some time, and having no trouble about the quality of the work. Then, out of a clear sky came the rejection of a good sized lot—enough to put a crimp in the profits for a long time. And the Milltown manager, Phil Parker, was sore. Brown, the chief inspector, Wilson, the production man, Harper, the sales manager were in conference, and Bill Holland, our free-lance industrial engineer, completed the group.

"Brown," said Parker, "the motor people say these gear sets are not up to specifications. They say they're noisy, that the tolerances are exceeded, and that they can't use them. And why does the shop send out gears and shafts that are not right, Wilson? Are these gear sets bad or not—and if so, why?"

"I have a hard enough job selling the stuff we make without having it queered by a lot of poor work," piped up Harper. "I tell them our work is good, and you throw me down this way. Nice chance I have of getting more business from them."

"I hate alibis, Mr. Parker," said Brown. "And I'm not going to spring one. It's perfectly true that few of those gear sets are absolutely according to drawings in every particular. You'll remember that both Wilson and I pointed out the ridiculous tolerances on some of the parts. Take that big gear, for example. There's a tolerance of two thousandths in the width of the face, when a thirty-second wouldn't make any difference.

"You may remember I pointed out that very dimension and you said to forget it—that they were reasonable people, and just put that dimension on so as to have a tolerance to shoot at. It's my notion that they put it on just to have a loop hole to reject gears when they didn't need any more."

"But they say they're noisy, Brown," said Harper.

"That's an easy complaint to make, Harper. You can't measure noise, and when they have gears enough for the season it's an easy matter for the rest of them to be noisy."

"Let's get at another angle," said Parker. "So far as you know, Wilson, and you too, Brown, were these gear sets as good as we've been shipping before?"

"Absolutely," spoke up both men.

"And you feel that the rejection is unfair?"

"We're sure of it, Mr. Parker."

"What's the answer, Mr. Holland?" asked Parker.

"If I knew, I'd be a millionaire, Parker; I've known many cases of this kind. When you accept an order with tolerances that are unnecessary, and bank on their being overlooked, you're taking a chance. But it's mighty hard to write specifications that neither side can crawl out of. That 'noise' clause is loophole enough for anyone—until we get a noise standard to go by."

"But isn't there any protection for the contractor?"

"It's been proposed that contract standards be set up for such cases, that impartial engineers look over the rejects and decide whether or not they are right or wrong. That is one reason for having standard fits, but if you sign a contract for closer tolerances, you are bound to carry them out."

"But you'd have a fine chance of selling the customer after you beat him in a trial," commented Harper.

"Perhaps the best answer is to deal only with people who play fair. If we could all do that we'd be happy. In the meantime, you might think over the suggestion for an impartial engineer to look them over."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own

problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Profits for Builder and User

The relation between cost of manufacture and purchase price is not a legitimate consideration for the buyer of equipment. The machine must earn a profit for its purchaser at the price he pays for it, and the higher the price the greater must be its gross savings over similar equipment. The well-known law of diminishing returns will determine the price at which it will no longer pay to buy.

If a manufacturer is able, by clever designing and efficient production methods, to offer a machine to the market which will out-perform all others, and yet construct this machine at less cost to himself, that is his good fortune and good management, and he is entitled to the rewards. Where the manufacturer has an exceptionally outstanding money-saving product, and is asking what appears to be considerably more than the customary price for such machinery, he must be prepared to convince the prospective purchaser that the machine, at the high price, will earn more money for him than what he uses at present.

—D. L. PARKHURST.

How Much Overhead?

Every production organization needs some kind of a convenient barometer by which to gage its manufacturing efficiency. A firm's earnings are not an accurate measure of the effectiveness of its factory management, since profits depend upon market conditions, and poorly-managed firms sometimes make money. Nor does the cost of the finished product furnish such a gage, for it involves fluctuations in the price of materials. We used to believe, as Mr. Holland's friends did, that the ratio of the total plant and supervisory expenses to the direct labor, that is, the ratio of overhead, was a good index of the state of health of the whole shop, or of any particular department. This may be true in the case of departments doing principally hand work or assembly work, but it was hard to reconcile this theory of overhead with the fact that the automatic screw-machine department, where each man ran three or four machines, showed 300 per cent overhead.

Since adopting the "machine-hour-rate" method of calculating our costs, that is, finding the cost of each job by adding together the material cost, the direct labor cost, and an hourly rate for the use of the machine and the space it occupies, we have had to find some equally simple index by which to check up the efficiency of our shop. We adopted the monthly figure for the total payroll cost per unit of product delivered, that is, the total payroll for the month divided by the number of units shipped in that month.

This figure has the big advantage of being simple to calculate and easy for the workmen to understand, and is independent of fluctuations in the cost of our raw materials. This "barometer" goes down every time we install a new high-production machine, or devise some new short-cut method, or do anything else which will enable the workman to turn out more work. Some of these changes may increase our "overhead ratio," but what the ratio of overhead is at present, we do not know, and do not care.

As an incentive to the employees, a standard payroll cost per unit is established, and the entire working force is given, as a bonus, one-half of any reduction in cost below this standard figure. The other half of the saving is set aside by the company as a fund for the purchase of new labor-saving machinery or tools, with the object of further reducing the unit cost.

—CHARLES SPRAGUE HAZARD.

The Man Over Fifty

If we give the subject sufficient study, we will come to the realization that the man over fifty still has a future. Development work, for example, requires considerable shop experience. It cannot be handled in the production department, for it would hold up the regular run. Isn't this a real field for the man over fifty, who knows his trade thoroughly, has good ideas, but is just a little slow in execution? The promotion will make him happy, and will add years to his life.

Foremen, straw bosses, and experienced mechanics are too busy in their regular production work to train new men in their trade these days. Who is better than the old man to act as instructor? He may be slow, but it is better to ground the apprentice in good shop practice and develop speed afterward, than to let speed cover up bad fundamental practice. These old men know the value of a good job from the bottom up, and will be patient enough to insist upon it.

In an industry where tool and die work is important, the old man may be placed in charge of the blueprint files in the drawing room. The draftsmen will invariably ask him whether there is anything capable of doing a certain job available in the shop, before they start a new design. There will certainly be occasions when he can produce a tool which by a small modification can do the contemplated job. These are a few of his possibilities. There are many more. The man over fifty has not let us down through his years of service, and we are not going to let him down to a night-watchman job.

—WILLIAM A. ASHMEAD.

The Comeback of Britain

By Dr. Julius Klein
Director, U. S. Bureau of Foreign and Domestic Commerce

Although suffering from excess labor, burdensome taxes, and virtual elimination as the world's middleman, the British Empire is maintaining her vast trade by investments in essential raw materials

THE British Empire is by all odds our leading customer and competitor. Its eight major units took about 2 billions of our exports in the fiscal year 1927-28, which represented more than 40 per cent of our total sales abroad. On the other side of the ledger our imports from the Empire totaled about 1⅓ billions or 32 per cent of our purchases from foreign countries. No further data should be required to demonstrate the imperative necessity of a scrupulously careful check by informed American merchants, manufacturers, bankers, and shippers on the trend of economic affairs in the British Empire. When, for example, the coal strike of 1926 gravely crippled the recovery of British Industries, or when prolonged hardships of her shipping were brought on by post-war developments, such as the new tonnage constructed by Germany, Italy and other competitors, or when the construction of textile mills in China, Japan, and India played havoc with her cotton exports, whenever such major casualties retard her economic rehabilitation, they have had a direct repercussion upon our own prosperity.

> "As long as England's industrial and commercial leaders are watchful of the economic changes which are going on throughout the dominions and in other newly awakened lands in the East and in Latin America, she will be in a position to capitalize the margin of new buying power for such opportunities as it affords for her special commodities"

Here is an illustration. Our sales to the United Kingdom in 1927-28 fell to 809 million dollars as compared with 844 in the fiscal year 1921-22; a repercussion from the severe trials encountered by British business during that trying period. To take a more specific example, raw cotton is by all odds the largest single item in our sales to the island kingdom, nearly exceeding in value the next two items together, namely tobacco and gasoline. Our sales of that staple to the United Kingdom in 1927 were valued at 140 million dollars as compared with 230 millions in 1913; the collapse was due of course to the disasters of that major British industry. Another evidence of the same development is the fact that whereas the world consumption of cotton has risen from an average of 13 million bales a year during 1910-14 to 14.9 in 1927, the importations of the United Kingdom fell during that period from 4.1 to 3.7 millions. This has meant that her share of the world's consumption has declined from about 21 to 12.4 per cent.

Our interests in the Empire are financial as well as commercial. The total American investments under the British flag in all parts of the world have risen to 3.8 billion dollars from about 775 millions in 1913. Canada accounts for 83 per cent of today's large total, but there is a notable increase in the amounts being poured into other units of the Empire, especially into Australia.

Even more significant is our rapidly increasing dependence upon the Empire as a source of essential raw materials for our growing industries. In pre-war days a large proportion of our purchases of such raw materials, notably rubber, wool, skins, tea, and tin, were made in or through London. Today, however, because of the complete dislocation of trade routes during the War, the bulk of our requirements of these essentials are filled by the producers without the intercession of the London distributors. For example, in the case of rubber, the decline was from 41 to 8 per cent and tin from 52 to 19 per cent. This shift has seriously affected an important phase of Britain's commercial strength, namely her service as an intermediary or distributor; the world-wide tendency to cut corners and introduce economies has inevitably involved a serious impairment of this middleman's function.

But, although this has crippled one limb of England's commercial organization, it has at the same time strengthened the position of her many interests, financial as well as commercial, in the exploitation of the sources of these raw materials in all parts of the world. This applies not simply to the rubber and tea plantations or tin mines of her own possessions; it refers to her very heavy holdings in lands which are politically independent, but economically very intimately linked with London. For example, the more than one billion dollars of British capital invested in Argentine railways collects a regular dividend from the heavy shipments of Argentine wool across the pampas and thence to the United States.

Much has been said of late regarding the amazing increase of American investments abroad and the statement is frequently circulated that the United States is today the world's dominant force in the field of investment capital. But the total of our private holdings abroad is now 13 or 14 billions, whereas those of England are in excess of 20 billions. The latter, however,

are increasing at the rate of about 560 million dollars a year, as compared with our annual accretions at an average of 1,131 millions during the past four years.

The strength and world-wide dissemination of these British holdings in raw material production enterprises accounts in part for the British concern over the recent activities of the American government against governmental activities in the field of raw material monopolies. The conspicuous example of this was, of course, the rubber development, but British interests are also evident through heavy investments in Chilean nitrate, Malayan tin, and other products largely concentrated in one or two countries. With the United States as the world's leading consumer of these materials essential for our growing industries, it is inevitable that any aggressive American policy intended to maintain competitive conditions in the world trade in them, would react sharply upon British commerce.

Consequently the abandonment of the Stevenson rubber restriction program by the British authorities on November 1, 1928, establishes the acceptance of an important principle in the trade relationships between the two great Anglo-Saxon traders. It would seem to be in effect a frank recognition that such efforts toward arbitrary delimitation of trade volume are not only futile but vexatious and mutually harmful. The stand thus very wisely taken by the British government sets an example which is likely to have far-reaching effects.

Trade Rivalry with U. S.

The question of trade rivalry between the United States and the United Kingdom has come up on many occasions, especially in recent years with the discussion of such contentious matters as tariff adjustments and debt settlements. It has been alleged that the onward drive of our exports has impaired the prospect for British commercial recovery in many once lucrative markets. For example, the amazing advance of the United States in Australia, where we are today supplying 22 per cent of the total imports as compared with 11 per cent in 1913, has brought despair to many British observers. Upon closer analysis, however, it is revealed that our exports to that important market consist of commodities which in the main are not seriously competitive with those from the United Kingdom. The latter's need for mining machinery, agricultural implements, lumbering and irrigation supplies, and road-building apparatus, all fit in aptly with our own domestic trade requirements and does not find in British industry a ready source of supply.

In other words, our trade advances in the Dominions have been, speaking generally, by no means made at the expense of the mother country, but have been evolved out of the expanding buying power of the colonies and their new requirements for which American specialties are peculiarly fitted.

This has emphatically not involved the destruction of England's trade prospects within the Empire. Her trade has gone forward and has capitalized in its own special manner the new opportunities created by the advancing buying power in the new dominions and commonwealths. For example, her exports to Canada rose in millions of dollars from 115 to 142 during 1923-27; in Australia from 167 to 297; in New Zealand from 52 to 95; and in the Transvaal from 28 to 40 during the same time. Today Australia and New Zealand afford an outlet for no less than 13.36 per cent of England's total export trade as compared with about 8.7 per cent in 1913.

We hear much of British-American rivalry in Latin America, but except for the River Plate region, there does not seem to be ground for serious fears on the part of American exporters as to the possibility of heavy losses to their British rivals. After all, Britain's major commercial interest has always been on the continent of Europe, supplemented more recently by the possibilities of Empire markets. It is in her trade with European neighbors that she has lost most heavily as the result of the wartime disruptions. For instance, in pre-war years her direct export to Russia approximated 90 million dollars, whereas in 1927 her sale there was less than 22 million; and if allowance be made for price changes in that time, it is evident that this trade has dwindled to a mere fraction of its pre-war volume. Last year, for the first time, the value of her exports to Germany ($203,000,000) passed their value in 1913 ($198,000,000), but this still represents a great curtailment of volume. For these reasons Britain has been in the forefront in the effort toward relieving the post-war reconstruction difficulties of the Continent. She has concentrated her efforts particularly upon the obliteration of the trade barriers which sprung up on all of the old boundary lines and especially along the 5,000 miles of new frontiers.

As long as England's industrial and commercial leaders are watchful of the economic changes which are going on throughout the dominions and in other newly awakened lands in the East and in Latin America, she will be in a position to capitalize the margin of new buying power for such opportunities as it affords for her special types of commodities. Unfortunately for her, it is true that many of the newly established industries in these countries are likely to turn out low grades of goods which will be in sharper competition with her exports than with the finer types characteristic of our trade.

This has already been fully anticipated by the more far-sighted British trade executives and they are once more following a policy adopted with satisfactory results before the War, namely the purchase or at least control of many such new factories overseas through British capital wherever possible. In this manner the new iron and steel, cotton, and paper mills, and other industrial establishments that are springing up in India, Australia, South America, and elsewhere overseas are being so controlled as to present a minimum threat to the older industries of the Kingdom.

Labor Difficulties

In some parts of the Empire the newer industrial growth has been momentarily impaired with labor difficulties, notably in Australia and India. These interruptions have on various occasions in the last two or three years impaired the prospects of a rapid industrialization and any appraisals of the outlook for this movement in these territories must be carefully gaged with this grave problem in mind. There has also been an occasional dearth of capital for various undertakings due partly to the more or less radical legislation characteristic of some provinces, but, broadly speaking, the authorities throughout the Empire are sparing no pains to attract industry, whether through favorable tariff arrangements, taxation preferment, or other types of legislative allurements.

So far as the general drift of her trade is concerned, the latest figures on the exports of the United Kingdom would seem to afford at least a reasonable encouragement. Britain's exports for the first nine months of each of the last three years, 1926, 1927, and 1928, have

advanced from 496 million pounds to 535 million pounds —an 8 per cent increase in value, which in view of the fact that prices declined slightly in that period was indicative of an even larger advance in volume. Nevertheless, the more rapid growth of the trade of the world as a whole has resulted in a decline in her proportion of the world's total. In fact, it has fallen from 15.4 per cent of the world's exports during 1911-13 to 12.8 per cent in 1927.

This is the problem which is now giving far-sighted leaders of England their gravest concern, since the continued strength of Britain in the field of manufactured exports is of prime importance to her salvation. Her foreign trade represents 80 per cent of her total commercial life and it is, except for coal, almost entirely made up of manufactures. In this field she still dominates the world since she supplies nearly 38.5 per cent of the total manufactures contributed by the four leading commercial nations in the world's commerce, whereas her share in 1913 was 37.8. This modest increase, however, did not match the relative improvement of the United States, whose portion rose in that time from 15 per cent to more than 23 per cent.

The outstanding feature of British business at present is the strengthening tie of imperial relationship. As one leading London journal expressed it, "in the expansion of trade within the Empire lies the brightest hopes for the prosperity of the British race." The imperial preference doctrine in trade matters is, of course, of long standing, having been developed in the middle decades of the nineteenth century, though with little enthusiasm until this present post-war effort. It is a policy that is universal and certainly not amenable to criticism from the United States since it is applied to our own trade with the insular possessions. So long as it does not involve flatly discriminatory devices, there can be no protest registered on the part of American business.

Preference Tariff Schedules

The imperial preference tariff schedules naturally will involve many commodities of interest to American exporters, for example, tires and other automobile accessories, tobacco, and various lines of foodstuffs. The spearhead in this general offensive is the British Empire Marketing Board, which is rapidly getting under way after its inauguration some two years ago. Its purpose is not simply the general development of intra-imperial trade, but also the stimulation of industries, the improvement of qualities of products of the various dominions, and a general program of imperial publicity and education. This work is to be forwarded by liberal subsidies and indirect aids not only from London but also from the various colonies and dominions.

Fundamentally, the work of this board is of chief concern to the United States, because of the possibilities of its reaction upon the buying capacity and general economic growth of the colonies. Our exports are bound to be stimulated as this movement succeeds, even though we may feel unfavorable repercussions from its competitive effort in a few lines.

Thus far the proportionate distribution of the trade of the various units of the Empire with one another as compared with their commerce on the "outside" does not show any great change since pre-war days. Approximately 40 per cent of the total imports of the members of the Empire come from within the group and they find markets for 44 per cent of their respective exports under their common flag. These figures are almost exactly the same as in the years just preceding the War.

The more recent trend of commercial relations between the United Kingdom and the rest of the Empire, however, would seem to indicate a slight weakening of the Empire tie. The percentage of the total imports of the United Kingdom during the first half of the years 1926, 1927, 1928, which came from Empire sources were 33.5, 30 and 31.4 per cent, respectively. And the comparable figures on the exports of the mother country going to markets in the Empire were 46.7, 45.9 and 44.3 per cent of her total sales overseas. In the case of these exports the amounts sold by the motherland to the dominions and colonies has remained almost exactly constant for each of the three half-years, namely about 157.5 million pounds, whereas her trade with the rest of the world has been gradually advancing. The import total from the colonies to the United Kingdom has declined during the half-years of the period mentioned from 201.9 to 190 million pounds. The total trade, both exports and imports, of this vast globe-encircling group of diversified kingdoms and commonwealths, with their more than 13 million square miles, and nearly half a billion of population, exceed 20 billion dollars, or more than double our 9 billions. It has increased nearly 60 per cent since 1913, which with allowances for price changes still represents a moderate margin of actual increase in volume.

"Safeguarding of Industries" Act

An important phase of the post-war rehabilitation of Britain has been the introduction of the protective tariff under the name of the "Safeguarding of Industries Act," which was passed in August, 1921. It expired in August, 1926, but was renewed for ten years. Originally, as the name indicates, it was intended to provide protection for certain industries closely allied with national defense. These were given protective tariff rates of about 33⅓ per cent ad valorem. The number of commodities has been gradually increased to include certain fabrics, cutlery, gloves, paper, buttons, and pottery. The rate as a rule has been about one-third ad valorem, though in certain cases it is a quarter and in others a half. Preferential rates have been extended to goods originating in the Empire.

The Board of Trade is authorized to hold hearings from time to time similar to those of our Tariff Commission, but with the difference that the British organization is empowered to put its recommendations into effect at once as to changes in rates. A notable instance where the Board refused to fix protective tariffs recently was in the case of the iron and steel industry.

In the final analysis the major accomplishment in further rehabilitation of the Empire as a whole, is likely to come only as the motherland mends her shattered economic strength. By all odds her paramount problem is that of labor and although she has materially reduced the number of unemployed receiving doles from an average of about 1.8 million during the latter half of 1921 to about 1,300,000 at present, there is still much to be done along this line.

Broadly speaking, this question of the status of labor is one of major importance in determining Britain's capacity for international competition. It has been feared by some that if she increased her wage scale so as to stimulate buying in acordance with the precedent of the United States, it might impair her competitive capacity in export. But it can be demonstrated from our experiences that this is not necessarily the case,—that high

wages do not necessarily mean high prices. If the figures for 1913 be taken as 100, the current wage rates average 260 in the United States and about 180 in Great Britain, but price levels in the two countries stand almost on a parity at 145 and 142 respectively. In other words, a heavy advance in wages is by no means necessarily reflected in price if the result has been achieved through increasing per capita output of workers, and, unfortunately, the British Census of Production has reflected almost no such per capita increase since 1907. The surplusage of labor in the island kingdom makes it extremely difficult, if not impossible, for the British employer to secure a compensating return on the high wage which he must pay through the introduction of labor saving devices, as is the practice in American industry.

The most encouraging indicator for the future is the unqualified adoption of the principle of co-operation in industry as advocated by Sir Alfred Mond. This program involves the establishment of joint industrial councils on an unprecedented scale, and is being greeted with wide-spread expressions of confidence and satisfaction; in fact, for the first time a really broad national program of co-operation between operatives and employees seems to be in prospect. The labor outlook is further brightened by the improving activity of shipping owing to good world crops and the stronger position occupied by the British iron and steel industry as the result of higher prices established by the Continental steel cartel.

There has been much talk of the introduction of economies in the British coal industry—automatic conveyors and better dumping devices, to enable the industry to show a larger per capita output in which regard the British worker stands far below his American competitor. The latter turned out 7,920 pounds in 1927 as compared with 2,308 pounds for the British miner. But, any such moves would inevitably result in further aggravation of this already grave problem of unemployment.

Some headway is being made through mergers and other organization devices to ameliorate the situation. The outstanding commercial legislation passed by the session of Parliament which adjourned on August 3, 1928, provided some urgently needed relief of local taxation. This is likely to aid the industry along with other branches of production and manufacturing. By doing away with three-fourths of the burden of these excessive local taxes on industrial production and by effecting lower transportation rates through readjustment of taxes, it is hoped that the coal industry might be particularly assisted since it is the one primarily concerned in these difficulties. In fact, because of the hardships in the coal industry, the Government has advanced the date on which the contemplated transportation relief becomes effective from October, 1929 to December 1, 1928, and is concentrating all relief on the movement of coal for export and for domestic use in the iron and steel industry.

Obviously there are many vital improvements still to be achieved before England can be regarded as squarely on her feet. She has been hard hit through world-wide transformations in the use of fuel — substitution of hydro-electric power and petroleum for coal, her textile industry has been shattered by the changes in styles and the development of native industries in once lucrative markets, her shipbuilding until recently was suffering sadly from the inroads of new merchant fleets equipped with highly economical Diesel motors and oil burners. But in all of these definite improvement has been made.

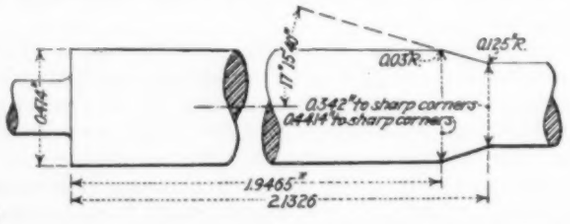
Indubitably the empire is gaining strength, and 1928 will probably set a memorable mark in that progression. From the point of view of American business, be it remembered that this is a strength which will manifest itself even more in the stimulation of the buying power of a market that takes more than two-fifths of the $5,000,000,000 worth of farm and factory products that we sell abroad every year, a buying power which, as it gains in momentum, will manifest itself most helpfully, not only in direct relations with us, but in invigorating our trade in thousands of markets in other parts of the world from which the empire in turn will be making new purchases.

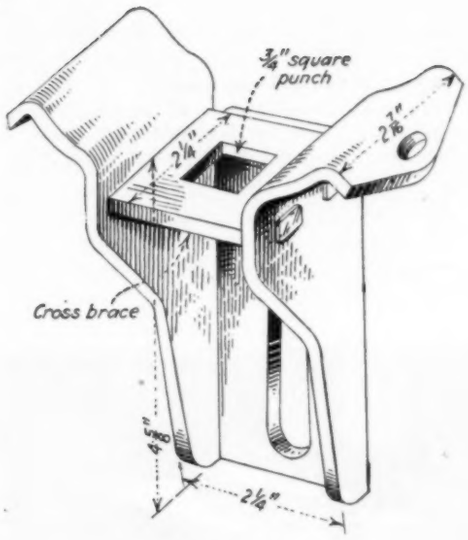
Britain will still have many problems—labor surplus; imperial harmony, economic as well as political; continued heavy taxation burdens; continental trade barriers; stagnation in her Russian and Chinese trades; world-wide distress in some of her leading staples. These are but a few of her many cares; but, after all, it is well to remember that Britain's commercial strength has been fed on just such rugged food for generations and centuries.

Can Your Inspectors Check This Gage?

Not without very special Equipment!

Even if the sharp corners were left on for gaging, an error of 0.0001 in. in the diameter, 0.4414, would make an error of 0.0062 in. in the length, and the maximum length tolerance is 0.006 in. Yet this kind of gage is handed out every day in hundreds of shops with no means of measuring it. Are we fooling ourselves on accuracy? The answer is given in a description of a new system of taper gaging in an early issue of the *American Machinist.*





A Sheet-Metal Bracket and How It Is Made

By Frank W. Curtis
Western Editor, American Machinist

A description of the operations and dies for making a metal bracket, and how a cross-brace is assembled to the body of the bracket

KNOWLEDGE of what can be done in a press is equally as important, for the designer of sheet-metal products, as ability to select the correct types of dies. The design of the cradle or bracket illustrated in the headpiece, and the method of manufacturing it, as worked out by the Saxon Die and Stamping Company, Toledo, Ohio, form good illustrations of this combined knowledge. The assembled bracket is used for automotive purposes, and houses a generator that is attached to it by means of screws and a formed metal strap. The bracket is made of $\frac{3}{16}$-in. steel.

An outstanding feature of the bracket design is the method by which the cross-brace is cut out of the blank, and then reconstructed into the body, being assembled and fastened entirely by press tools. As formerly designed, the brace was made separately, and then welded in place. The revised method has not only simplified manufacture, but has also reduced the cost.

The following operations are performed:

1. Cut out blank
2. Pierce all holes except elongated opening
3. Cut out section to be used as brace
4. Form ears and generator seat
5. Insert brace and form body U-shape
6. Stake cross-brace in place
7. Pierce elongated opening.

Neither the blanking nor the piercing dies are unusual in design. They embody the conventional form of sub-press die design, each having four leader pins on account of the size and thickness of the part. A double-run blank layout, as shown at *A* in Fig. 1, has been selected because of the shape of the part. The appearance of the blank after it is pierced is seen at *B*, a total of 8 rectangular and two $\frac{1}{2}\frac{3}{2}$-in. holes being perforated simultaneously.

The next operation cuts out the cross-brace as illustrated at *C*, producing a small blank that has two tongues on two opposite edges. The die for the operation is of the plain blanking type in which the work is located for alignment by nest plates. Next in line, the blank is formed at the forked end in the die illustrated in Fig. 2, which is mounted in an incline press. Both ends are formed to a semi U-shape, as shown by the part resting on the bolster plate at the lower left. The work rests across the top face of the die, receiving its location from three points. A solid-type punch, fastened to the ram, then descends causing the blank to take the shape indicated.

For assembling the cross-brace and forming the body to shape, the die shown in Fig. 3 is used. The body section is placed flat on the lower die section, fitting a nested surface against which it is held by two flat locating springs, as shown at *A*. The cross brace, or insert, is placed against the inner surface of the upright member *B*, being held from the previously-pierced central square hole by a spring-type plug. In locating the insert in place, it is turned at right angles to its relation when it was cut out of the blank. The upper portion of the die, or punch, is a plain block shaped to the width of the desired bend in the work. When the ram descends, the punch strikes the work, then continues downward causing the opposite sides of the blank to fold upward. The upright member is attached integrally to the spring pad on which the work rests, so that the insert likewise descends, the action causing the tongles to enter the

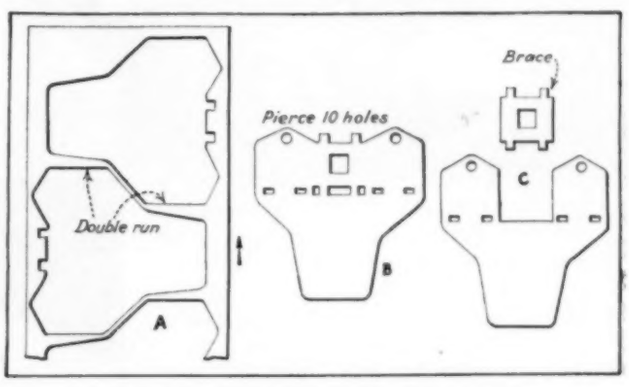


Fig. 1—A double-run blank layout, A, is used to reduce the scrap. Following the blanking operation, the part is pierced, as shown at B, and the cross brace is cut out of the blank, as shown at C. Sub-press type dies are used for the blanking and the piercing operations, and an open-type die for cutting out the insert

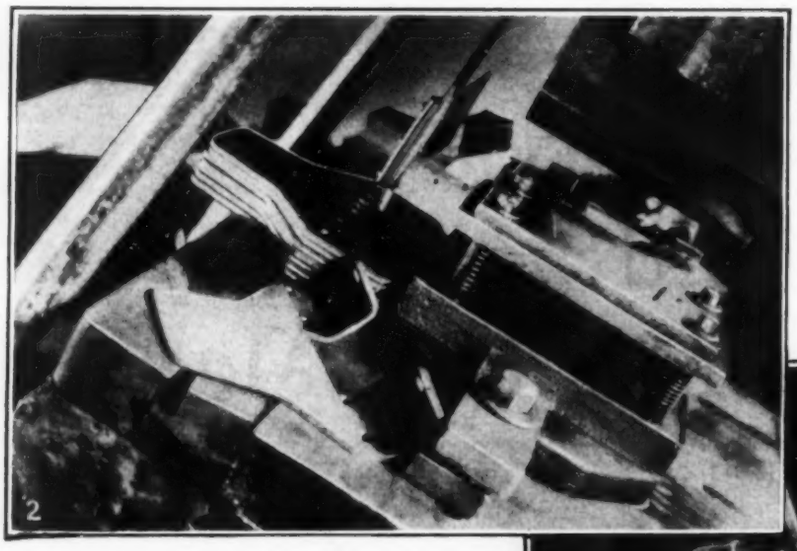


Fig. 2 — The first forming die turns up the outer ends of the bracket. When the solid punch descends, the ends of the work take a U-form as shown by the completed piece at the left of the die. The press is of the inclined type

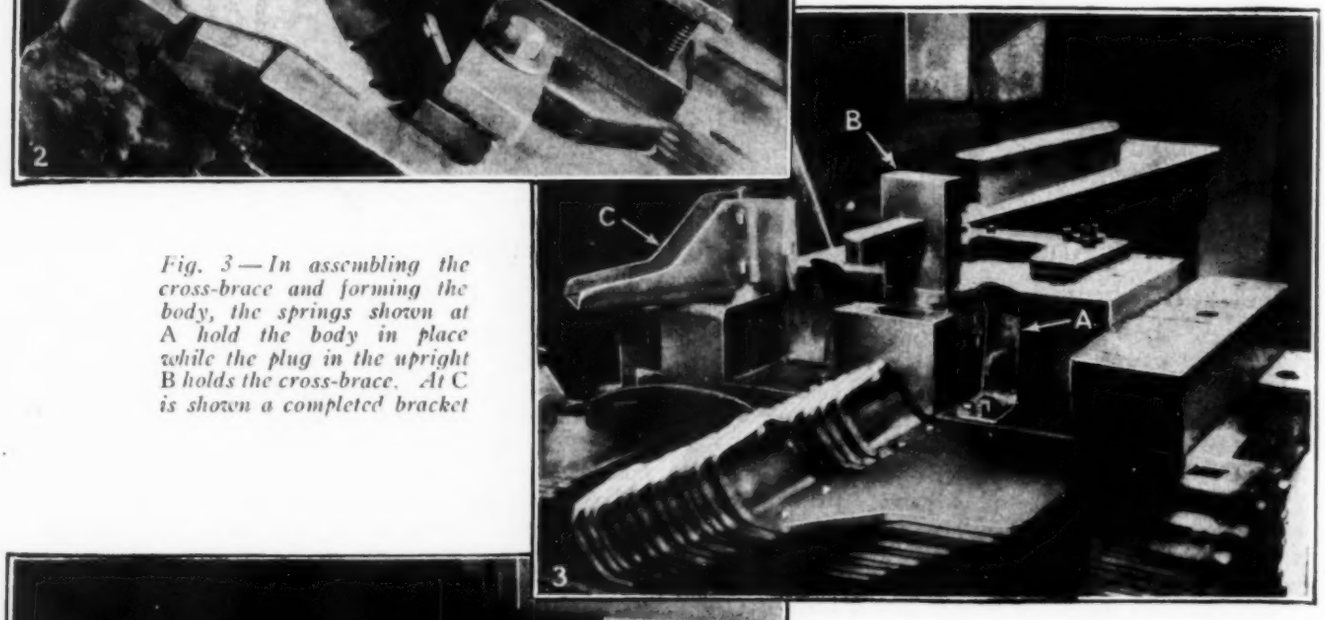


Fig. 3 — In assembling the cross-brace and forming the body, the springs shown at A hold the body in place while the plug in the upright B holds the cross-brace. At C is shown a completed bracket

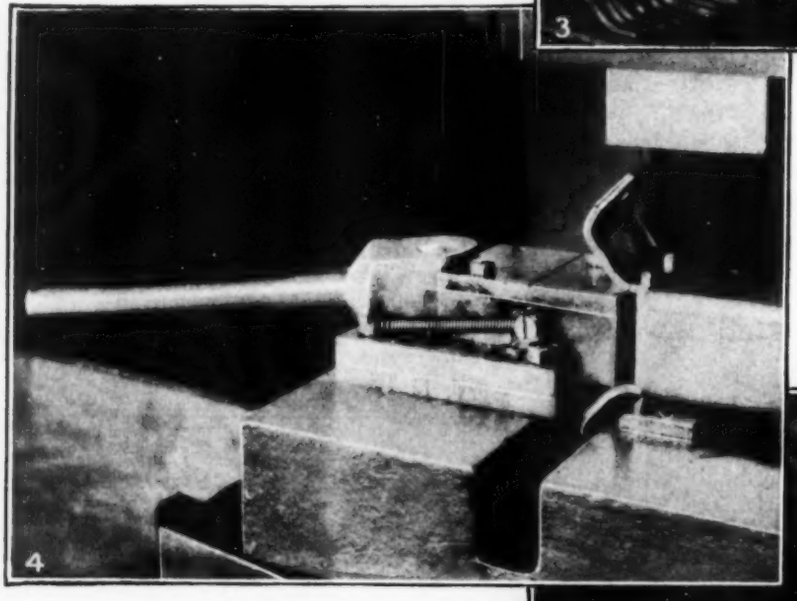


Fig. 4—The projecting ends of the insert are staked in this die, one side being completed at a time. A similar die is used for staking the opposite side. The work is held firmly in place by a sliding block operated by a cam

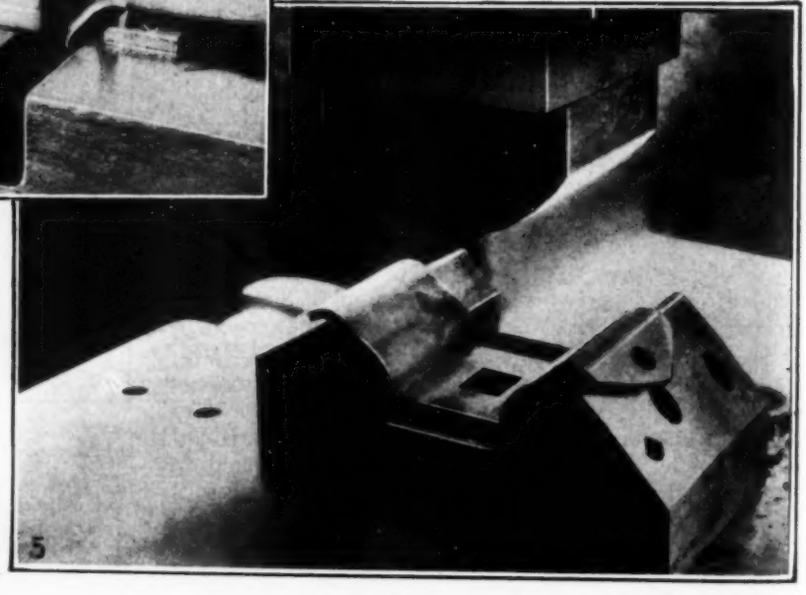


Fig. 5—Since the generator seat is formed before the body is made in a U-shape, it is necessary to restrike the seat, the operation being performed in an open-type die with a solid die block and punch

rectangular holes of the body as the U-form is made. At *C* is shown an assembled bracket, and in front of the die may be seen several blanks and inserts before being assembled and formed in the die.

The projecting ends of the tongues are staked in the die illustrated in Fig. 4, which is arranged with a sliding-type clamp block, operated by a cam, which holds the piece firmly in place over a staking block. Two staking tools are attached to the punch, and complete one side of the assembly at a time. A left-hand die of similar design is used for the staking of the opposite side, being interchanged with the die shown after a quantity has been completed.

When the U-form is made in the body of the bracket, the radius seat for the generator distorts slightly, therefore, it is necessary to restrike the face as shown in Fig. 5. The die is of the solid type, holding the work in an upright position, while the punch, also solid, is shaped to the radius of the generator. The final operation is the piercing of the elongated hole at the lower end of the bracket, this operation being performed in a plain-type piercing die.

Johnson Chucks the Time Clock

By John R. Godfrey

I SAT in on a sort of triangular conference the other day that interested me a lot. There was Old Man Johnson, his son Tom, and Bill Thompson, one of the foremen. I was the audience. Bill is one of young Tom's proteges, and I half suspect that Tom knew what sort of fireworks were scheduled to come off.

"Just starting a little family row, Godfrey," said the Old Man as I came in. "I don't know just what it's all about, but I guess we're likely to know soon. Bill here, seems to be bustin' to tell me something and I'm guessing it's about that new timekeeper I put on the job awhile ago. What's on your chest, Bill—get it off." "Nothing much except that my gang's all set to tar and feather that bird, or quit the job, unless you can knock some little gleam of ordinary intelligence into that pimple he wears over his collar, and calls a head. Talk about having sense enough to go in when it rains—he don't even know when it's raining. He's one of those ex-army officers who thinks it's more important to fire the sunset gun just on the minute, than it is to get rations for his men. I've worked in a lot of shops, Mr. Johnson, and I've never seen a more loyal bunch of men than you've got right here. But you're going to lose that loyalty and good will if you let that sort of a chap carry out his fool notions of discipline and efficiency. He's got room for only one idea at a time, and just now that idea happens to be time clocks and punctuality. He doesn't seem to care about what a man does after he gets here, if he's only on time by the clock."

"Don't just see what that has to do with loyalty, Bill," chimed in the Old Man.

"Well, you're likely to know darn soon, Mr. Johnson. The men are sure riled up and something'll bust loose before you know it. Loyalty ain't all one-sided like this bird seems to think. You know better, for I've heard you say so. This time-clock stuff has got 'em all ravin'.

"They don't mind the time-clock idea at all. They know there's got to be some way of keeping track of jobs, and also that every shop has a few 'laters' who never get up on time, or do anything else when they ought to. But they don't cotton to the idea of a time clock that's only got one end that counts.

"You know that whenever we've been pushed for delivery, the boys have always been glad to help out—and they have helped out lots of times without a cent of overtime. You know that Old Charlie Leach is always at his work from a quarter- to a half-hour ahead of time. It's a habit with him—or else a disease, and he doesn't drop his work just as the whistle gives the first toot, either.

"But what does it get him? Not a darn thing, with this new timekeeper. There was a tie-up on the trolley line last week, and Charlie was seven minutes late. And the next blacklist paraded his name just as prominently as it did the name of the man who'd been late seventeen times last month. All Charlie's extra time in the morning and at night don't count at all. He's posted just the same as though he was a real slacker, instead of being the most faithful man you ever had. And it hurts Charlie worse than being docked a half-day's pay. The rest of the men are sore, too. Charlie hasn't said much about it, but he's boiling inside. And if I were that timekeeper, I'd stay away from Charlie's corner of the shop. It's just possible that some of the boys might have a hammer with a loose head, and it might, accidently of course, fly off when he happened to be there. What the boys can't see, is why an extra ten minutes at night shouldn't go on the dope sheet, as well as the two minutes late in the morning. It's the total time worked that really counts in production, in spite of Capt. Timekeeper and his fool notions. It used to be a favorite saving of yours, Mr. Johnson, that the good man never watched the clock—and I don't think you meant only quitting time either. But if this bird stays on the job, you'll have a bunch of the finest clock watchers out of captivity, and they'll watch the twelve-o'clock and five-o'clock ends just as closely as they do the other end of the session. You'll lose not only the extra time, but the interest of the men. Those who stay will keep their ears cocked for the quitting whistle, till they can tell about two seconds before it starts to blow.

"It wouldn't be so bad either, if the timekeeper didn't play favorites. But there are a few of the foremen who are late five times a week, and never a mark on the blacklist to show it. That gets the men sore too, Mr. Johnson—it's so unlike you to play favorites in anything, and

you mustn't forget that the boys don't have any way of knowing that this isn't being put over by your orders. It may seem like a little thing to you, Mr. J.—but it doesn't look that way to them—and it wouldn't to you if you were in their place."

"But I punch the clock myself, Bill—it never bothers me any."

"Now Mr. J., I'm surprised that you'd pull that old gag. What's punching the time clock got to do with your job? Would it make any difference to you if the record showed you late every day in the year? Would your name go on the blacklist to be posted by the gate? Would you feel the same way about it that old Charlie does? 'Course you wouldn't."

"He's got you there, dad," piped up Tom. "And I think Bill and the boys have a real grievance. If you'll just go off on another trip and take old "brass - buttons" with you, Bill and I'll iron out the wrinkles and get the boys to thinking the Old Man isn't such a bad old chap after."

"What would you do, Bill, if it were your shop—let the boys get here whenever they happened to feel like it?"

"Of course not. But I came from a shop where the time clock had never been put up. They had a nice one about half uncrated, and kept it where everybody could see they had one. If the "laters" became too numerous they'd pull another slat off the crate, after all. And the boys didn't need a map to see the answer. Every foreman kept an eye on his men, and habitual laters were reminded of their shortcomings, tactfully, but forcibly. Unless they reformed, the rest of the boys sort of encouraged 'em to feel that there were better jobs in other shops and they drifted away. We had time stamps that showed when every job was started and ended, so we could figure costs. If a man had to be late, he made it up, and more, before the week was over. There weren't any blacklists on clock watchers in that shop. One always goes with the other. And if your time-clock maniac knew anything about human nature, he'd have known it long ago. That's one thing that military schools don't seem to teach. Some learn it afterwards and are splendid managers, but the average army man's idea runs to time-clocks, guard houses and similar methods of running a business."

Bill stopped, Johnson turned to me.

"Suppose it sorts of tickles you, Godfrey, to see me get panned. But I'm inclined to believe that Bill and the boys are more than half right. I've a good notion to chuck the time clock for six months and see how it works. How does that suit you, John R.?"

To which I could only reply that it was worth trying but the trouble wasn't so much with the time clock as it was with the "time-clocker," and that I'd send him to watch the clock while it was having its vacation.

Mass Production of Airplanes
Discussion

By John F. Hardecker

THE editorial on page 700, Vol. 69, of the *American Machinist* presents a clear and concise picture of the aeronautical industry today, as well as points out the inevitable future trend. While it is to be regretted, the fact that many of the present-day small manufacturers must go in the march of production progress, is not to be denied. There should, however, be a distinct field of usefulness for them in the industry as standardization is developed, which is generally being overlooked at present.

The present tendency to manufacture planes in small shops, where every plane is almost an individual problem, must give way to standardization. But as standardization develops, it might provide an outlet for the aeronautical activity of these smaller organizations, which, if properly handled, may become permanent. There is no reason why these smaller shops, instead of attempting the construction of complete planes without proper production facilities, whose initial costs would be practically prohibitive to most of them, could not undertake specialized aeronautical manufacture as standardization develops.

Such fields would include tank construction, float construction, standardized metal stamping, wing and tail ribs, power plant accessories, and other innumerable items. To equip for the manufacture of such items on a truly production basis would not involve investments beyond their present resources, provided that they concentrated on one or two specialties. It might save them from inevitable elimination from the industry, besides providing a distinct contribution to the advancement of aeronautical development. This is their real opportunity.

When Safeguards Are Shelved

By Frank V. Faulhaber

THOSE machine shops that have installed improved machines in favor of the dilapidated old ones have found that there is less risk, and that new machines often are easier to operate, with the result that accidents are reduced. Also those machine shops that have taken steps to provide special devices in the interest of safety have been similarly rewarded by the move. Yet, what of the machine shop that will have some toolmaker go to considerable trouble shaping some safety appliance for a machine when no efforts are made to follow up the good work?

There comes to mind one small machine shop that had been having considerable trouble because some of its men hurt themselves while running machines. The superintendent decided that safety appliances would forestall accidents, but, when these were furnished, some of the men neglected to use them. One man made the interesting observation: "Oh, we use them when inspectors come around. Those guards are only a hindrance."

Not far from his machine another operator injured two fingers because he had failed to use the safeguard as provided. Both these men have seen the light and are wiser. To provide safety appliances and not utilize them is on a parity with the shop whose executives outline a new set of rules, yet do not enforce them. It is all typical of half-way work, and we all know what that hints, particularly when the executives are guilty of it.

Punches and Dies for the Bulldozer

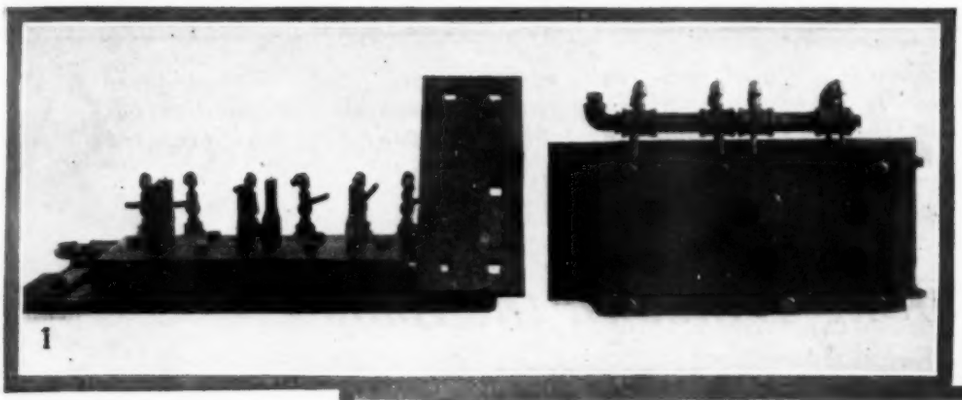


Fig. 1—Punch and die for frog riser plates. The plate with the six holes punched is shown in the center. The punch is at the left and the die at the right. The plate to be punched slides into the die under the stripper plate held by the six cap screws shown. Both punch and die are cooled with water jets

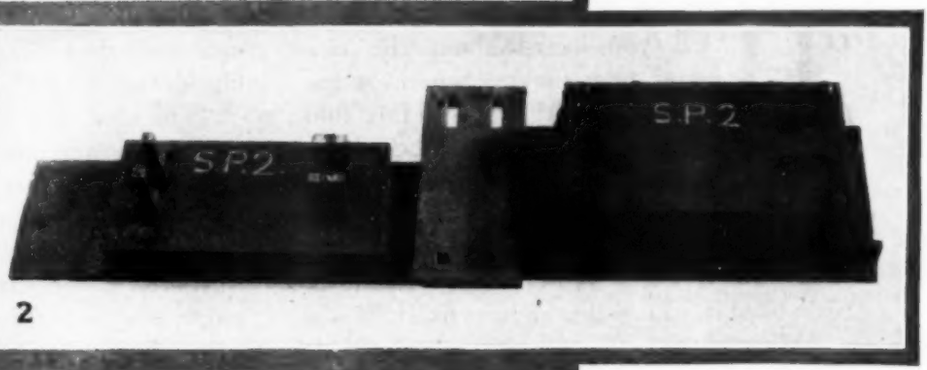
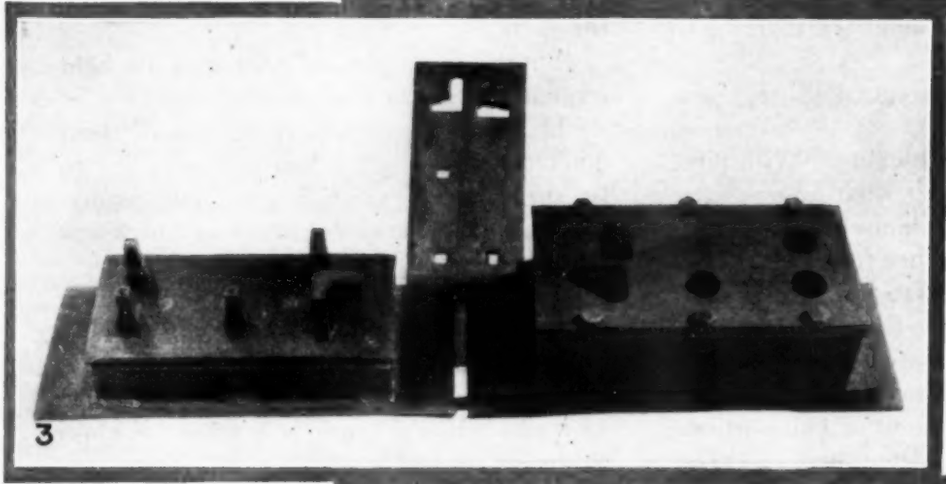


Fig. 2—Tool used in punching a front guard-rail plate. The punched plate is shown in the center. It will be noted that each punch has a spur or center that helps to guide it and prevent any side movement after making contact with the plate to be punched



Photographs by courtesy of the Canadian National Railways, Moncton, N. B.

Fig. 3—Another guard-rail punch and die. There is a large, right-angle punch at one corner. The completed plate is shown between the punch and die. The operation is similar to that on the examples previously shown

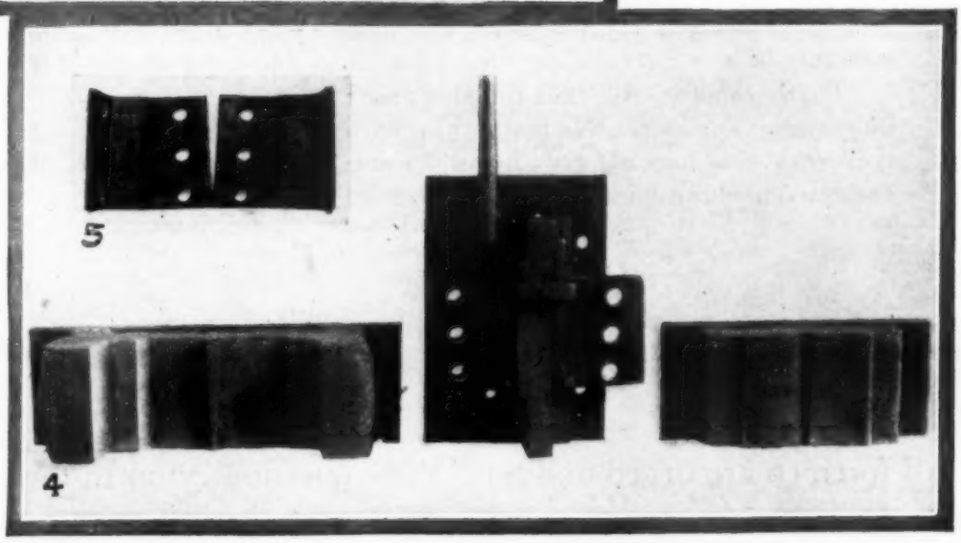


Fig. 5—A pair of the transit clips showing how the wedge-shaped punch cuts out the piece that leaves the edges at the proper angle with the rest of the clip

Fig. 4—Punches and drill jig for a transit clip. Two clips are formed at one operation, and the punch shown at the left separates them, making a right and left clip at each stroke of the bulldozer. Between the punch and die is a drilling jig that makes it easy to drill the holes in the clips in their proper position

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Gang Bonus in the Shop

"HAVE you heard about the new bonus plan they've put in at the Pump shop, Al? Billy Hare told me about it last night. They've chucked the old piece rate and the whole crowd works on a gang bonus."

"I hadn't heard of it, Ed. I know some shops use it but I didn't know anyone in town used it. How do the boys like it?"

"Most of the boys are kicking—want their old piece rates back. I don't see anything to it, do you?"

"Seems to me it has possibilities," answered Al.

"But it cuts out individuality. With piece work each man knew just what he was earning. It all depended on himself. Now it depends on whether the other fellow is as good as he is. Doesn't seem fair, Al."

"Depends on how you look at it, Ed. As I've heard about the system, each man has a guaranteed hourly rate. This rate isn't all alike, but varies with the value of the man. Besides the fixed rate there is a chance to earn a bonus if the output of the shop warrants it."

"That's about it, Al. But the men aren't independent any more. No matter how hard they work, they may not get a bonus if someone else lies down on the job. Why not let each man do his own earning? What's the big idea anyhow?"

"The idea, Ed, is to get out more production at a lower cost. No matter how many pump cylinders one man may finish a day, the company can't sell any pumps unless there are pistons and valves and all the other 'dinguses' to go with 'em. They don't want parts, they want complete pumps. So they pay a bonus for complete pumps only, not for parts."

"But how can the cylinder man be held responsible for the rest of the gang?"

"He's just out of luck if the rest of them don't come through. And he's very apt to let them hear from him good and plenty. He'll likewise hop on the foreman's neck and tell him a few things."

"But suppose a fast man has a few kinks that help him get work out in a hurry. Isn't the company losing the benefit of these?"

"Perhaps the company figures that if the fast man wants a bonus he'll show his kinks to the others and speed them up. Then, too, if the gang is getting behind, the fast man may dig in and help some of the others, so as to get *complete* pumps out and so get the bonus."

"I don't like it, Al. Takes away too much individuality."

Is Ed right in feeling that gang bonus cuts out individuality of the men? Or is Al right in his idea of the plan? What are the facts about group bonus?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Holding Back on Piecework

IF A stock clerk keeps records of how much finished product comes from a 10-ft. bar or strip of stock, and issues material on manufacturing orders, then a workman cannot hold back his output for a rainy day. He cannot make less than his order if it is filled, nor run over if he does not have the material.

It is very true that a man's capacity varies with his moods and feelings, and if he is "off his feed" his output suffers. That is one of the reasons piecework protects the employer if an epidemc of spring fever sets in; the payroll drops till it is over with. —CHAS. H. WILLEY.

THREE reasons might be given for the practice of not turning in a maximum day's production. First, the men fear that the price will be cut so low that they will not be able to make their regular pay, or at least will have to work too hard to do so. Second, there is the desire to have something in reserve to draw on when things go wrong, and they are unable to get their day's pay out of the day's production. Third, there is the quite common belief that a man is not allowed to make any more than a certain amount. An order that a man must put on his time sheet all that he does would be foolishness. Production would be slowed down to the generally recognized safety point.

To overcome the above, the confidence of the operators must be obtained. To compensate for the loss of their reserve, the operators must be thoroughly recompensed for losses over which they have no control. It will be found that the idea of the high limit is, in some shops, due to the foreman's disapproval. High earnings are taken as a reflection on his ability as a price setter, and often bring inquiries from the office. Also, he may dislike the idea of pieceworkers earning more than he does himself. —JOHN ALEXANDER.

THERE is nothing unusual about Bill's experience of finding a man holding out on piecework. Anyone in close contact with piecework knows that, in some shops, an operator cannot be so foolish as to turn in the actual amount produced every day. However, the amount turned in each week will usually tally fairly closely. It is no secret that an operator cannot produce the same amount every day. This is sometimes due to circumstances over which he has no control. Take for example a grinder hand. He sometimes gets wheels that perform better than usual. Again, slight variations in the hardness of the material affect his production. Al knows the average manager's weakness for going after that biggest day's work, and it don't usually take very many to bring about a cut. —WALTER W. YAEGER.

THE practice of holding back work is common in shops where rates are poorly adjusted and where loose production plans are used. In these shops rates are often cut if a good workman puts out a little above average, even if that particular lot happens to be one where everything is in his favor.

It is because of such conditions as this that some form of bonus wage payment is becoming common. This is especially true of systems where the man's efforts are measured in units of time and trained observers can judge very closely his working speed. In these cases, rates or allowances are properly set and then guaranteed against cuts unless conditions are changed.

—L. F. SWANSON.

Equipment and the Foreman's Reputation

BILL JENKS, who quit his job because the boss wanted him to work with obsolete machines, may conclude after thinking it over carefully, that he acted unwisely, and perhaps sacrificed a real opportunity. There he was, foreman in a shop which was making money, but which could have made more by following some of his recommendations in regard to the mechanical equipment. He was in position to do the necessary missionary work for new equipment, by the use of a little patience and persistence, and possibly by writing for some production estimates from the builders of the machines that he had in mind. He threw away the chance to make a real reputation for himself as a man who appreciated the larger aspects of his job, and who was upholding the interests of the firm, even to the extent of opposing the views of his superiors.

—CHARLES S. HAZARD.

IT IS very discouraging, not only for the foreman, but for all the employees, to work for a firm that makes no effort to grow. The man who has to start at the bottom can hope to advance only by making connections with a growing firm, and growing with it. If the foreman is progressive, he cannot be loyal to a firm that seeks

THE · NEXT · TOPIC

Preventing Spoiled Work

ADVANCE QUESTION

Williams posts a bulletin that 85 per cent of spoiled work is unnecessary. Ed thinks it is mostly due to carelessness. Al feels that it is due to lack of training. What is the answer?

to pocket all the profits. Bill Jenks is to be congratulated for the stand he has taken. He feels that he cannot be loyal to the firm because he does not approve of its policy. Rather than continue working for it, he has resigned. A man of his type is much more desirable than the man who knocks the firm and all of its executives, and continues working for them. —W. J. Owens.

The Boss's Son in the Shop

OUR friend Al is certainly right. The "Big Mogul," if he earned his job, knows he is tempering the breeze for his lamb. Opinions may differ as to whether it makes any real ultimate difference. However, genuine fighting men can be produced only on the battle field, which, in this case, is some other factory where his father is unknown, and son gets the gaff and an opportunity to show that he can deliver under fire.

—A. J. Trott, *Canada.*

HAVING had three years' personal experience very similar to the one that confronts the boy, I know that there is bound to be a different feeling toward him by the employees. I venture to say that the tricks that shop men play on each other will be more numerous in his case, even though they have to be executed a little more cleverly. Many a time he will take hold of a machine handle and find his hand resting in axle grease, prussion blue, or some other substance used in machine shops. I sincerely hope that these pranks will help him to master his temper, and in future life make a bigger and broader man out of him.

It is my belief that the father will appreciate the fact that his son is being treated as one of the boys, and it will be to the boy's advantage, as well as to that of the foreman, if he is given the hardest and dirtiest work in the department. I personally would not hesitate to have the boss's son work for me, provided he was sincere.

—Harry S. Taylor.

Should the Men Support Their Own Club?

IF THE men have to pay the entire expenses of the club themselves, it will be necessary to charge them a large fee. The fairest way would be for the firm to provide the clubhouse and general overhead expenses. The men should bear the expenses for any class of amusement in the proportion in which they participate.

If more members are wanted, membership may be extended to the employees of other firms. The fee for these men should include both their share of the firm's subscription, and the fee paid by the employees of the owner company. —W. E. Warner, *England.*

IF THE management desires to associate itself with the club, and to show that the executives are really interested in the welfare of their employees, the better method is to offer prizes in each section of the activities. The occasional appearance of members of the managerial staff will do far more to create the desired spirit than would be the case if the club was run by the firm. During working hours the workmen are ruled by the management, and if, in hours of leisure, the workmen themselves are allowed to manage the club entirely, they will get some idea of the difficulties to be faced. In this way a feeling of mutual understanding will arise.

—T. L. Ronald, *England.*

Wear Goggles or Quit

ANY executive who expects that his men will wear goggles just because it is a general shop rule, is sadly mistaken. The obeying of this rule is like the development of shop spirit, it must be the result of understanding, co-operation, and education. When an accident occurs, or an eye is saved, whichever it may be, the incident should be given all the publicity possible.

There are many safety posters covering the hazards of not wearing goggles. These should be used properly, not plastered all over the plant and forgotten, but posted one at a time and changed frequently. A foreman should aim to induce his best and oldest employees to wear goggles, thus setting an example for the others. Furthermore, the foreman himself should make it a point to find occasion to use a grinder and wear goggles himself to show that he is in earnest. —A. Mathieu.

Hiring in the Open

WHAT would Ed's first impression be if, when going to look at a new machine, he found it in a dark room with just enough illumination to indicate its presence? Put the same machine in a nicely arranged and well-lit showroom, and a different impression will be obtained. The same machine looks worth more money.

Likewise, when purchasing labor, I wonder if Ed's judgment is so acute that he can size up his man by talking to a face. Better bring your man inside, put him at his ease and take advantage of a scheme that gives you a better insight of the attributes of the applicant.

—S. H. Bailey, *England.*

Letting Good Men Get Away

ED SEEMS to be missing the keynote of better relationships between men and management, which is frankness. Obviously, he cannot promise an opportunity which doesn't exist, nor should he promise definitely that an individual will be given a promotion, if and when an opportunity occurs, since conditions may change considerably by the time the opportunity occurs. Unless he has the final say, he should avoid promises, for nothing so destroys good relationships as an unfulfilled promise. Under no circumstances should definite promises be given, or even inferred, unless the definite situation and means of carrying them out are fully established.

What Ed should do, is to tell the man of his good work, which is a fact, and what the future may hold, which is a possibility. In describing the possible consequences of the man's good work, care should be taken to convey to him that they are only possibilities, and the factors which might influence it favorably or unfavorably may also be explained. Of course, no reference to his own supervisor's possible attitude should be made by the foreman, and he should avoid creating a situation whereby if the man doesn't get the job, he will feel that it was the "higher-ups" who turned him down. If the man in question is really the proper man for possible promotion, he will confirm that opinion by his open-handed acceptance of the foreman's frankness. If he's not, and insists he wants a definite promise regardless of circumstances, then he has fortunately disclosed in advance that he lacks at least some of the qualities which go with greater responsibility. —Guy A. Grubb.

A New Development in Corrosion-Resisting Steel

By Frank R. Palmer
Assistant to the President, Carpenter Steel Company

This paper points out a means for improving the machining and grinding properties of high-chromium steels by the use of zirconium sulfide

MACHINABILITY in high-chromium corrosion-resisting steels has been the subject of much study in shops where its use has been considered. Certain machining operations have been economically handled by specially ground or specially designed tools, but there is an urgent need for a free-cutting stainless steel which can be cut rapidly and economically with the ordinary shop tools and equipment. It was toward the solution of this problem that the present study was directed. The difficulty in machining high-chromium steels does not lie in their inherent hardness, nor is it because they work-harden like manganese steel. The difficulty lies in the manner in which the chips adhere to the cutting edge of the tool. For some reason, these steels have a very high coefficient of friction, and tend to adhere to any surface with which they are brought into dynamic contact. This same tendency causes difficulty in grinding due to the chips adhering to the grits, and thus loading the wheel.

In showing that stainless irons and steels can be made nearly as free-machining as common screw stock without loss of stainless properties, and without serious loss of physical properties, this paper is an important addition to the general knowledge of the high chromium materials

Of collateral interest is the tendency of these high-chromium corrosion-resisting steels to gall, scratch, or seize in service. Pump shafts, valve stems, gate valve seats, and similar moving parts sometimes gall or seize —particularly if the pressures are high, and it was expected that a solution to the machining problem would favorably affect these other factors.

The original research on this problem centered about a corrosion-resisting steel, frequently called stainless iron, of the following type analysis:

Carbon, per cent	0.10	Silicon, per cent	0.40
Manganese	0.40	Chromium	14.00

The work developed in three distinct stages:

First, phosphorus and sulphur were added, individually and jointly, in quantities up to about 0.12 per cent. Steels of these analyses forged and rolled well, but showed little or no improvement in machinability.

Second, phosphorus up to 0.50 per cent, and sulphur up to 2.00 per cent were added. The phosphorus had little if any beneficial effect on the machining properties. The sulphur proved to be the answer to the machining problem, but resulted in a commercially unworkable product in the hot condition.

The third phase of the development consisted in finding a form of sulphur which retained all the advantages of the pure metalloid, with none of its disadvantages. It ultimately developed that zirconium sulfide completely answered this specification. The ultimate analysis proved to be:

Carbon, per cent	0.10
Chromium	14.00
Zirconium sulfide	0.40

This zirconium-sulfide treatment was applied to steels with chromium contents from 7.00 to over 25.00 per cent, and, in all cases, it functioned effectively. Zirconium sulfide appears to affect in no way the corrosion-resisting properties of the base analysis. Salt spray and commercial tests indicate that the zirconium-treated product will work out satisfactorily in contact with the same chemicals as are resisted by ordinary stainless iron.

Specimens for testing the comparative resistance to scaling at elevated temperatures were prepared by machining hot-rolled bars down to about ½ in. in diam. with a finely prepared surface. Pieces of both materials were exposed at the same time to a temperature of 1,600 deg. F. for 8 hours in an electrically heated muffle furnace. From the tests we should regard these two samples as equal in scale resistance, showing that zirconium sulfide has no effect upon this property of the steel.

Hot-Working Properties

Stainless iron treated with about 0.40 per cent zirconium sulfide can be safely forged or rolled at temperatures up to 2,100 deg. F. This figure represents the safe maximum temperature; higher heats are likely to show evidence of tearing in forging or rolling.

Since regular stainless iron can be forged as high as 2,300 deg. F., it will be seen that the new steel is not as fool-proof as the older analysis. On the other hand, 2,100 deg. F. is a reasonable temperature at which to conduct any sort of hot-working operation, and no instance has yet developed where the product treated with zirconium sulfide could not be satisfactorily hot worked

Abstract of paper presented at the tenth annual convention of the American Society for Steel Treating, Oct. 8 to 12, 1928, at Philadelphia.

into the form desired. It is readily rolled into bars, drop forged, or rolled into plates and sheets.

The presence of zirconium sulfide in high-chromium corrosion-resisting steels seems to increase the critical cooling speed. It is well known that stainless iron, of the type being considered, hardens almost as readily in air as it does in oil. The modified type containing zirconium sulfide, will not appreciably harden in air, and seldom shows a Brinell hardness greater than 230 as it comes from the rolls, hammers or dies.

Stainless iron containing zirconium sulfide will harden in oil but does not become quite as hard as the same analysis without the zirconium sulfide. It has also been observed that zirconium sulfide raises the temperature necessary for hardening stainless iron. Whereas, the base analysis will harden very satisfactorily at 1,700 deg. F., with the addition of 0.40 zirconium sulfide, it becomes necessary to raise the hardening temperature to about 1,825 deg. F. On drawing stainless iron, the martensite break-down temperature is about 950 deg. F. Zirconium sulfide does not alter this figure.

Typical tensile properties of stainless iron, both with and without zirconium sulfide are shown in the accompanying table. It will be noted that zirconium sulfide reduces the elastic ratio, the elongation, reduction of area and the impact resistance. There is, however, no indication of brittleness in the new steel at any stage of the heat-treatment, and the product treated with zirconium sulfide proves entirely trustworthy for any service within the capacity of its tensile properties.

It is well known that stainless iron containing 12.00 to 14.00 per cent chromium is not subject to excessive grain growth when held for a long time at incandescent temperatures. Zirconium sulfide does not in any way alter this property.

Makes Machining Easy

The presence of 0.40 per cent zirconium sulfide renders stainless iron just about as freely machinable as common screw stock. This conclusion has been confirmed in dozens of commercial shops which are regularly working ordinary screw stock. Due to the fact that the chips do not adhere to the tools, the new steel can be drilled, tapped, threaded, broached, reamed, and otherwise machined with the same tooling as used for regular shop work.

When machined in the heat-treated condition, zirconium sulfide effects the same proportionate improvement all along the line. That is, compared with regular stainless iron, the new steel shows about the same advantage in machinability regardless of the Brinell hardness range being tested. Cap screws $\frac{7}{16}$ in. in diam. have been machined, in screw stock set-ups, from hard-drawn stock of about 235 Brinell, in 30 sec. each.

Improvement in Grinding Properties

Stainless iron has never been a particularly attractive metal to grind and polish. Gratifying improvement has been effected by careful attention to abrasives and grinding conditions, but there is still much room for improvement. The principal difficulty seems to be due to the steel loading up the wheel and thus interfering with the grits taking hold of the work. The addition of zirconium sulfide to stainless iron minimizes loading of the wheel and tends to keep the job cool. The steel therefore grinds more rapidly and takes a better finish.

Several attempts were made to design an accurate and satisfactory test for measuring relative frictional properties. Thus far the attempts have not been successful. It became evident that quantitative results would only be accurate when the samples were prepared with absolutely duplicate surfaces. Since two steels of different frictional tendencies will not take the same finish with the same abrasives, the difficulties of duplication can be appreciated. Further work is being done along this line but, in the meantime, some qualitative comparisons taken from commercial application will be of interest.

Physical Properties of Stainless Iron With and Without Zirconium Sulfide

	Stainless Iron	Stainless Iron plus Zirconium Sulfide
Hardened and Drawn at 700 deg. F.		
Yield point, lb. per sq.in.	125,800	128,000
Tensile strength, lb. per sq.in.	155,200	163,500
Elongation in 2 in., per cent	17.2	13.7
Reduction of area, per cent	55.2	35.3
Brinell hardness	341	348
Izod impact, ft.lb.	36	32
Hardened and Drawn at 1,100 deg. F.		
Yield point, lb. per sq.in.	99,500	94,000
Tensile strength, lb. per sq.in.	116,000	113,000
Elongation in 2 in., per cent	22.1	17.7
Reduction of area, per cent	71.7	52.4
Brinell hardness	228	241
Izod impact, ft.lb.	82	48
Drawn at 1,425 deg. F.		
Yield point, lb. per sq.in.	68,000	65,500
Tensile strength, lb. per sq.in.	88,000	87,600
Elongation in 2 in., per cent	30.8	25.5
Reduction of area, per cent	73.2	59.3
Brinell hardness	170	170
Izod impact, ft.lb.	96	87

It has been found that wire made from stainless iron containing zirconium sulfide can be satisfactorily cold drawn without the use of a copper coat. The pressures and temperatures in wire drawing, particularly by the dry process, are quite high, and, for this reason, the better drawing qualities of the new steel appear to be quite significant. Machining and grinding have already been mentioned. The superiority of the zirconium treated product appears to hinge largely on the ability of the chips to clear themselves and get out of the way. Face rings on high-temperature, high-pressure gate valves have shown a slight but definite advantage in favor of the zirconium-treated material. Piston rods have been found to wear glossy in packings where stainless iron has a tendency to roughen and scratch.

Conclusions

It is really hard to draw definite conclusions regarding a subject which presents so many variables, but all of the above straws tend to show the direction of the wind. It is hoped that, at some later time, some quantitative data will be available on the subject of galling. For the present it can be stated that zirconium sulfide occurs in stainless iron in the form of minute particles uniformly distributed throughout the steel, and that these microscopic particles seem to serve as a sort of lubricant.

Welded industrial piping has for its first advantage its lower cost. This is best illustrated by a comparison of the cost of a welded header as against one made up with screwed or flanged fittings. Welded joints eliminate leaks, thus requiring practically no maintenance expense. To these advantages can be added the saving afforded by the possibility of using lighter pipe.

· BOOK · REVIEWS ·

ENGINEERS, 1928. Professor Albert Sauveur, Harvard University, Editor-in-Chief. Over 1,400 pages, 8¾x11¼ in. Cloth board covers. Published by the Neo-Techni Research Corporation, New York, N. Y. Price $25.

LISTINGS of manufacturers in the engineering fields, together with the principal officers and engineers of these firms, and engineering data in handbook style, form the content of the book, "Engineers." Section I is devoted to civil engineering data and listings of manufacturers of products pertaining to civil engineering; the next section to electrical engineering, section III to mechanical, and section IV to mining and metallurgical engineering. The fifth section contains 113 pages, on 14 subjects such as, a list of the engineering societies and foreign information agencies, a set of mathematical tables, a treatise on selling to engineers, lists of government departments, and universities of engineering.

The listings of manufacturers is by geographical location, with subdivisions as to kind of product. An alphabetical index and a geographical index of manufacturers, and an index of the engineering data are included.

CONSTRUCTION OF ALIGNMENT CHARTS. By George W. Swett, associate professor of machine design, Massachusetts Institute of Technology. Ninety-two pages, 5½x8 in. Cloth board covers. Published by John Wiley & Sons, Inc., New York. Price $2.

DESIGNERS and engineers will find in "Construction of Alignment Charts" a handy text of principles and examples that will enable them to construct charts for problems which arise in their everyday work. Mathematics beyond elementary trigonometry do not appear anywhere in the book. The first step in preparing an alignment chart with the aid of this book, would be to read the first chapter of fundamentals. Next would come a comparison of the equation at hand with the standard forms of equations given by the author and a study of the author's method for handling that form of equation. Practical problems are also given.

MANUFACTURING. By Malcolm Keir, professor of economics at Dartmouth College. Six hundred eleven pages, 5¾ x 8¼ in. Cloth board covers. Indexed. Published by the Ronald Press Company, New York, N. Y. Price $5.

IT IS well claimed by the author of this book that most people's understanding of economics is unorganized and is in generalities. The book "Manufacturing" does not attempt to tell the "how," but the "why." It aims to give its readers a comprehensive knowledge of the country's industrial structure, its industrial development, and the relation of this development to other phases of national life. The book is the first one of a series of nine volumes under the general title "Industries of America." The others relate to specific industries, finance, transportation, etc., but the present volume is the one that will be probably of most interest to men in the mechanical industries.

The book is divided into twenty-four chapters. It begins with an economic description of American agriculture and its relation to manufacturing, following through the stages of household manufactures, the peddler, advancement of power, and the development of the factory system. Separate chapters are devoted to the major industries of iron, steel, meat, cotton, wool, silk, leather, shoes, paper, cement, and glass. Two chapters discuss American labor and the problems of labor. Each study of a specific major industry, such as steel, comprises a history of the industry with the related economics bearing on labor, organization, and distribution, and ties in with the whole subject of manufacturing economics. On the surface the subject of meat packing does not seem to be of interest to the metal-working industries, but from this book the executive in the latter field is able to obtain a comprehensive idea of the rise of a great industrial unit and its relation to the industrial structure of the nation.

THE THEORY OF FILM LUBRICATION. By R. O. Boswall, lecturer in mechanical engineering in the College of Technology and in the University, Manchester, England. Two hundred and eighty pages, 5½x8¾ in. Cloth board covers. Published by Longmans, Green and Company, New York. Price $5.

MR. BOSWALL is apparently the first to give engineers, research investigators, and advanced college classes a complete treatment of the theoretical side of film production based on the laws which govern the viscous flow of liquids. The fundamental equations for the various flat and cylindrical surfaces are mathematically developed, with exact methods where possible, and with approximate methods where necessary. Part of the work is, of course, a summary of the best writings, but part, particularly on cylindrical bearings, is original. It is not claimed that the theory agrees perfectly with tests, but it is certain that practice and research will benefit by a better understanding of the fundamentals underlying the formation of the film. The author has done a good job in presenting these fundamentals.

STATISTICAL ABSTRACT OF THE UNITED STATES, 1928. By Department of Commerce, Bureau of Foreign and Domestic Commerce. Eight hundred forty-one pages, 5¾x9 in. Cloth board covers. Published by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Price $1.

THIS book requires no introduction to the thousands of readers who have come to know it in the fifty years of its publication and to depend upon the statistical information it carries on many subjects.

For the benefit of those who have not studied its pages as yet it can be described as primarily a digest of data collected by all statistical agencies of the National Government. It is a book of very definite value to anyone who works with statistics from our Government, providing he will use the information he there secures only after he has made himself thoroughly acquainted with the conditions which have resulted in the data given.

TRADE STANDARDS OF THE HYDRAULIC SOCIETY—FIFTH EDITION. The principal changes from the preceding edition consist in a revision of the extracts taken from the A.S.M.E. test code for centrifugal and rotary pumps, and changes in materials recommended for the construction of special-service pumps, in line with the latest accepted practice. The pamphlet contains 80 11x8½ pages, profusely illustrated. It may be obtained from the secretary, C. H. Rohrbach, 90 West St., New York, N. Y., the price being 50 cents per copy.

· TECHNICAL · ABSTRACTS ·

Ball Bearing Lineshafts Cut Operating Costs

For ten years ball bearings have been used on its lineshafts by a lathe manufacturing company with a minimum of service and power loss. Five main lineshafts are used, which range from 108 to 125 ft. in length. About 150 ball bearings are used on these lineshafts and another 50 on the jackshafts. The shaft speeds range from about 150 to 450 r.p.m., and but one or two bearings have been replaced during the ten years of service.

In all cases the lineshaft hangers were mounted on wooden footings, which were in turn bolted to 8-in. channel irons supported on edge by the heavy steel roof trusses. This method of mounting the hangers leaves little to be desired from the standpoints of strength, rigidity, and accessibility, in case it becomes necessary to make any changes in location or layout of the lineshafts or the machines themselves.

At the first of each year, the covers from all the ball bearings are removed, and they are washed out with kerosene, wiped dry, and then are repacked with heavy grease. It takes a force of about three or four men about a month to go over all of the ball bearings inasmuch as this work must be done only on Saturday afternoons. This is the only attention to lubrication that they receive during the year. Once a year the lineshafts are trued up. Whatever adjustments are necessary on the hangers are made by the use of a transit, as this has been found to be the most convenient and accurate means of checking the correctness of the alignment. It is not known how much power has been saved by the use of ball bearings, but it is known that the actual power and service costs are very low, and that after ten years of service these ball bearings give evidence that they are able to continue in operation for many more years.—F. Schoeffler, *Industrial Engineering*, November.

Labor's Stake in American Industry

More than a billion dollars is the measure of employees' investments under stock distribution plans of their employers. This estimate takes no account of the additional stock holdings acquired in their own or other corporations by workers on their own initiative, in the absence of subscription plans fostered by employers. Such a situation, quite unexampled in the economic history of this or any other country, scarcely can fail to have far-reaching effects.

Even a casual consideration of the subject raises in the mind of the observer a whole series of questions: What are the purposes of employers in encouraging workers to become shareholders? Is labor becoming converted to capitalism? Is the ownership and control of industry passing into the hands of wage earners? What will be the effects of employee stock ownership upon the relations between management and labor?

At about the same time that mounting wage levels were becoming an important factor in the business life of the nation, the workers were given impressive lessons in investment by the floating of the successive Liberty Loans. This wartime experience made America a nation of investors, and, once formed, the habit persisted. Corporations began to count their shareholders by the hundreds of thousands. Public ownership, in a wholly new sense of the term, became the established system in many of the largest enterprises.

Among the more logical motives behind the movement for stock distribution, one of the most important is the sincere desire of many employers to help their workmen save money. Behind this desire there often is a genuine interest in the workers' well being, and a desire to help them achieve economic security. Then, there is the question of support in old age—a question that mounts larger every year and attracts increasing attention from labor experts and forward-looking employers. Many managers have also been impelled, at least in part, by the desire to enlist the workers' interest in the success of the business.

Transfer of Control?

Are we witnessing the gradual transference of the control of industry to the hands of the wage earners? Probably not. Even if it were safe to assume that within a measurable term of years the majority of all the industrial and railroad shares in the United States would pass into the hands of employed wage earners, this would not necessarily mean any change in corporations themselves. The degree of control exercised by the individual shareholder, especially if his investment is small, is imperceptible. Sometimes he has the choice of delivering his proxy to one or the other of two contesting factions, but if the management is doing a fairly good job, even this degree of influence is rare.

But to say that employee shareholding is not likely to transfer the control of industry to the wage earners, is not the same thing as to say that it exerts no influence upon the policies of management. A company with thousands of stockholders is certain to take an attitude toward the small investor quite different from that of the concern whose shares are closely held. And this difference becomes still more noteworthy if many of these small stockholers are employees. The ultimate effects of this situation would be difficult to predict, but it certainly opens up interesting possibilities.—Edward S. Cowdrick, *Coal Age*, November.

Ferro-Alloys Affect Case Carburization

The fact has been established that various metals and non-metals may be absorbed by iron or steel when the latter are covered with the carburizing compounds and heated to temperatures below fusion, and that most of these elements, when present in steel, either accelerate or retard the absorption and migration of carbon during the progress of the carburizing process. It has been found possible to produce a deep case without a zone of free cementite by using an ordinary carburizer in conjunction with ferro-silicon and by employing higher carburizing temperatures, thus shortening the time required for completing the case carburization.

It is unquestionably true, that both temperature and concentration gradient affect the velocity of carbon migration, but the first factor has greater influence than the last. Migration proceeds more rapidly as the temperature rises on account of increased atomic mobility.

Silicon exerts an influence in the direction of retarding carburization. In the experiments the carburizing material used was a commercial compound and the ferro-alloy was 50 per cent ferro-silicon, shown to possess by analysis 0.32 per cent of carbon. In the case of steel the results indicated that the effects of ferro-silicon admixtures in a carburizing compound were to diminish carbon penetration at the highest temperature used, to eliminate the hyper-eutectoid zone of the case and to widen the hypo-eutectoid zone. At the lower temperatures it would seem that ferro-silicon increases the total depth of penetration.

Similar experiments on iron, using a mixture containing 20 per cent of ferro-silicon at a temperature of 1,740 deg. F., show the elimination of the zone of free cementite from the outer case under time and temperature conditions which would otherwise produce such a zone, but without seriously affecting the case depth. Higher temperatures may be used to accelerate carbon migration and shorten the time necessary for the production of a given case depth by more than 60 per cent, at the same time eliminating brittleness of the hyper-eutectoid outer case. In these experiments, a rise of 108 deg. F. was sufficient to reduce from thirteen to five hours the time necessary for the production of a case of given depth without free cementite—E. G. Mahin and R. C. Spencer, *Fuels and Furnaces*, November.

IDEAS · FROM · PRACTICAL · MEN

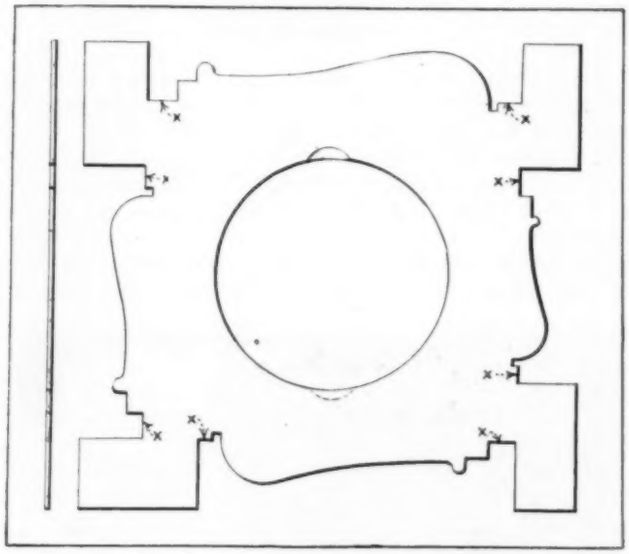
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Templet for Drawing Machine Handles

By Joseph E. Fenno

One concern building machine tools has found it profitable to furnish its draftsmen with templets for drawing machine handles, such as the one illustrated. The templet contains the half outlines of four sizes of handles.

In use, the templet is placed against the T-square,



Templet for drawing machine handles

with one of the edges *X* on the center line of the part of the drawing where the handle is to be located. After one-half of the handle has been drawn, the templet is turned so that the other half can be completed. The use of a templet of this kind saves much layout work.

Making Erasures on Tracing Cloth—*Discussion*

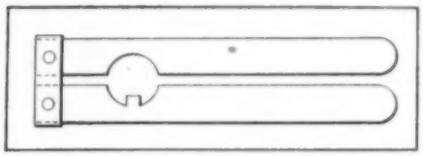
By Francis M. Weston

The erasing machine referred to by Matthew Harris in the article under the title given above, on page 593, Vol. 69, of the *American Machinist*, has long been obtainable commercially in very convenient form, and is handled by several dealers in drafting supplies. A wide range of circular erasers is offered, and the best I have found is a very soft one— softer than the usual pencil eraser. It is No. 4,000, made by Weldon Roberts, Newark, N. J. With this eraser, it is possible to remove ink lines from a tracing with ease and speed, and the rubber is so soft that, with ordinary care, there is small probability of rubbing a hole in the cloth. An object having a hard, smooth surface, such as a sheet of celluloid or glass, slipped under the spot to be erased makes for a cleaner and quicker job.

Wrench for Tightening Adjusting Nuts of Micrometers

By John T. Colfer

As a part of my duties, I am called upon to adjust micrometers for a large force of men. The micrometers of one make are each provided with a spanner wrench for the adjusting unit. Quite often the wrenches slip and take corners off of the slots, and sometimes they break. In the one case, it meant repairing the nuts or getting new ones, and in the other, using a new wrench. To avoid this, I made the wrench shown out of saw blades. This wrench cannot slip so long as the handles are pressed together tightly.

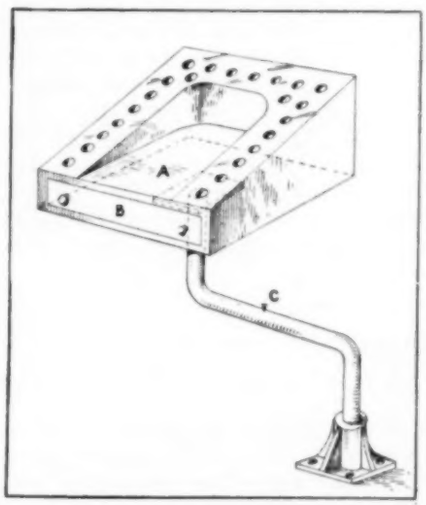


Wrench for adjusting micrometers

A Rack for Drills and Taps

By P. H. Pearson

The illustration shows a very convenient rack for holding drills and taps that are most frequently used in the course of a day's work. The drills and taps are generally left in the sleeves for the Magic chucks so as to facilitate production.



A tool rack for the drill press

The block is made of pine and has a number of holes which are clearance holes for the drill and tap holders. They are drilled at a right angle to the slanting face of the block. The shelf *A*, made by cutting into the block, and the drawer *B* are

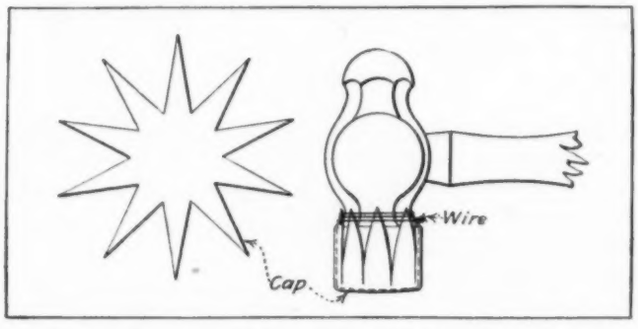
very convenient places for keeping wrenches and other tools. The block is about 20-in. square, and attached to the bottom is a steel plate into which is welded a plug. The plug is a snug fit in the bent tube *C*. The tube, in turn, is a snug fit in the base, which is made from a piece of large tubing and boiler plate, welded together. The base is bolted to the bed plate of the drill press and the rack can be swung into any position desired.

An Improvised Soft Hammer

By S. Udo

Mechanics often find it necessary to use a soft hammer to prevent marring the work. When no such hammer is at hand, a good substitute can be made by covering the flat end of a ball-peen hammer with sheet copper.

Cut out a ten-point star from the sheet copper, leaving the center as large as the end of the hammer to be covered. Fold up the points of the star on the hammer head and fasten them with a wire.



The copper star and how it is applied to the hammer

The sketch shows the star cut from the sheet of copper, and the method of its application to the hammer.

Re-Covering Cyclone Heads by Welding

By I. E. Hindman

In the plant where I am employed we have a number of cyclone heads, and the plate coverings rust out very rapidly. The practice has been to use the heads until they were full of holes, then they were taken down and new ones were installed. The average life of a cyclone head under the conditions at our plant is about one year. Each head is about 24 ft. long, 8 ft. in diameter, weighs about 6,000 lb. and costs about $1,000, installed.

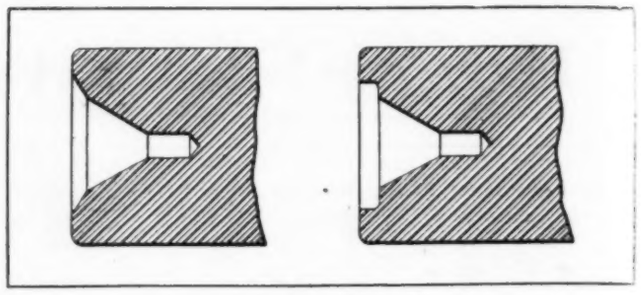
Now, we re-cover the heads while they are in operation. We bend ⅜-in. boiler plate, 6 in. wide, to the proper curvature and attach the plates to the original covering by arc welding. The work is done without any shut down to the plant, and the approximate cost is $95 for material and $175 for labor.

Protecting Centers

By H. C. Kline

A frequent source of annoyance when one has occasion to sharpen or grind a tool, is to find that the centers have been badly battered, necessitating either recentering the tool or setting it up in the steadyrest.

When the rough stock for the tool is centered, it should be relieved for protection. This relief can be made by a counterbore or even by using a regular drill somewhat larger than the center drill. The slight extra expense will be more than offset by the fact that the relief will aid in keeping the tool true while it is in use, and by the time that will be saved in sharpening.



Centers protected from damage

Assembling Piston Pins in Connecting Rods and Pistons

By D. B. Wedge

In order to assemble pistons and connecting rods by inserting the piston pin in place, the Continental Motors Company has provided the hand-operated device illustrated herewith. The piston is placed in the block *A*, which is bored the correct size to receive it, and the small end of the connecting rod is inserted between the piston pin bosses. A piston pin is entered in one of the holes in the block, and the hand-operated plunger at the left is then pushed forward against the piston pin, pushing it into place in the piston. The three parts are thus assembled into a complete unit.

Fixture for assembling connecting rods and pistons

By this method piston pins of the proper size are forced in without distorting the pistons. It also gives the operator an opportunity of testing the fit of the rod on the pin, or of the pin in the piston.

Abbreviations for Engineering Terms

A symbol is a letter or sign used in a formula as a substitute for any numerical value. A shortened expression for a name or a unit is an abbreviation and not a symbol. Abbreviations should be used sparingly in text, and with regard to the context and to the training of the reader. Terms denoting units of measure are abbreviated in the text only when preceded by the amounts indicated in numerals; thus "several inches," "one inch," "12 in." In tabular matter, specifications, maps, drawings, and texts for special purposes, the use of abbreviations is governed by the desirability of conserving space. Do not use conventional signs for abbreviations in text.

Alternating-current (adjective)	a-c.
American wire gage (Brown and Sharpe)	B.&S. gage
Ampere	amp.
Ampere-hour	amp-hr.
Antilogarithm	antilog
Atomic weight	at. wt.
Atmosphere	atm.
Average	avg.
Avoirdupois	avdp.
Barometer	bar.
Barrel	bbl.
Baumé	Bé.
Birmingham wire gage	B.w.g.
Board feet (feet board measure)	f.b.m.
Boiler horsepower	boiler hp.
Boiling point	b.p.
Brake horsepower	b.hp.
Brake horsepower-hour	b.hp-hr.
Brinnell hardness number	B.h.n.
British thermal unit	Btu.
Brown & Sharpe gage	B.&S. gage
Bushel	bu.
Calorie	cal
Candlepower	cp.
Candlepower-hour	cp-hr.
Center to center	c. to c.
Centigram	cg
Centiliter	cl
Centimeter	cm
Cent	c.
Chemical	chem.
Chemically pure	c.p.
Circular	cir.
Circular mils	cir. mils
Cologarithm	colog
Conductivity	cond.
Constant	const.
Cosecant	csc
Cosine	cos
Cost, insurance and freight	c.i.f.
Cotangent	ctn
Cubic	cu.
Cubic centimeter	cu. cm., cc (liquid)
Cubic foot	cu. ft.
Cubic feet per second	c.f.s.
Cubic inch	cu.in.
Cubic meter	cu. m
Cubic yard	cu.yd.
Cycles per second	~
Cylinder	cyl.
Day	spell out
Degree	deg.
Degree Centigrade	C
Degree Fahrenheit	F
Diameter	diam.
Direct-current (as adjective)	d-c.
Dozen	doz.
Electric	elec.
Electric horsepower	e.hp
Electromotive force	emf
Feet per minute	f.p.m.
Feet per second	f.p.s.
Foot	ft.
Foot-candle	ft-c
Foot pound	ft-lb.
Free on board	f.o.b.
Freezing point	f.p.
Frequency	freq.
Gallon	ga.
Gallons per minute	g.p.m.
Gallons per second	g.p.s.
Grain	spell out
Gram	spell out
High-pressure cylinder	H.P. cyl.
Horsepower	hp.
Horsepower-hour	hp-hr.
Hour	hr.
Hundred	C
Hundredweight (112 lb.)	cwt.
Hyperbolic sine	sinh
Hyperbolic cosine	cosh
Inch, or inches	in.
Inch-pound	in-lb.
Inches per second	i.p.s.
Indicated horsepower	i.h.p.
Indicated horsepower-hour	i.hp-hr.
Intermediate-pressure cylinder	I.P. cyl.
Internal	int.
Kilogram	kg
Kiloliter	kl
Kilometer	km
Kilovolt	kv
Kilovolt-ampere	kv-a
Kilowatt	kw
Kilowatt-hour	kw-hr.
Lineal foot	lin.ft.
Liquid	liq.
Logarithm	log
Low-pressure cylinder	L.P. cyl.
Mass	mass
Maximum	max.
Mean effective pressure	m.e.p.
Melting point	m.p.
Meter	m
Mile	spell out
Miles per hour	m.p.h.
Milligram	mg
Milliliter	ml
Millimeter	mm
Million	spell out
Million gallons per day	m.g.d.
Minute	min.
Molecular weight	mol. wt.
Ohm	spell out or Ω
Ounce	oz.
Peck	pk.
Penny (Pence)	d.
Pennyweight	dwt.
Pint	pint
Potential	pot.
Potential difference	p.d.
Pound	lb.
Pound-foot	lb-ft.
Pound-inch	lb-in.
Pounds per square foot	lb. per sq. ft.
Pounds per square inch	lb. per sq. in.
Power factor	spell out
Quart	qt.
Radian	spell out
Revolutions per minute	rpm
Revolutions per second	r.p.s.
Round	rd.
Secant	sec
Second	sec.
Shaft horsepower	s.hp.
Shilling	s.
Sine	sin
Specific gravity	sp. gr.
Specific heat	sp. ht.
Square centimeter	sq. cm
Square foot	sq. ft.
Square inch	sq. in.
Square kilometer	sq. km
Square meter	sq. m
Tangent	tan
Temperature	temp.
Tensile strength	tens. str.
Thousand	M
Ton	spell out
Ton-mile	spell out
Versed sine	vers
Volt	spell out
Watt	spell out or w
Watt-hour	w-hr.
Watts per candlepower	w.p.c.
Weight	wt.
Yard	yd.
Year	spell out

From the tentative American Standard Abbreviations for Scientific and Engineering Terms.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Why the Government in Pensions?

A SIGNIFICANT sign of the times may be seen in the labor legislation being introduced by the new president of Mexico, especially that pertaining to old-age pensions. Incidentally, also, it shows the method of approach to an economic problem by government compulsion in a country where there still remain vestiges of the medieval caste system, rather than by the usual American method of negotiation and co-operation between employer and employee.

The Mexican legislation calls for the workmen to pay into a national pension fund a definite percentage of his salary, and the employer to pay an equal sum into the fund. Essentially the same legislation was passed by the Argentine Congress several years ago, but was temporarily suspended because of difficulties encountered in building up a government bureau to take care of it.

The American approach to this problem of providing for the old age of the workmen has been slower, but possibly more practical. Most important, it has been a natural growth, and does not bear any of the odium of government coercion. A study made in 1927 showed that more than 4,000,000 workers in the United States were covered by formal and informal pension plans, and that the number was growing constantly.

The old theory that pensions are simply deferred wages has been fairly generally rejected in the United States. It has been shown time and again that employers do not have to pay pensions in order to secure and hold a labor force. Neither can the pension be considered as a charitable gratuity. In this country, where pension systems have been adopted, they have been accepted as part of the industrial relations policies of the employer on a sound basis of ethics.

The contentment, loyalty, and improved efficiency that have come with old-age pensions have been effects rather than causes. The willingness to "do the right thing" for the industrial worker and his family when that worker has passed the age of efficient production is what the modern American industrialist seeks through his personnel department, when the "right thing" is shown to be right and progressive. Such a policy relating to all personnel problems leaves no need for coercive legislation and government interference in the normal progress of business.

The Cutting Tool Problem

SPECULATION is not confined to the stock market at present. In the engineering and sales department of every progressive manufacturer of metal cutting machinery, speculation is rife as to the next step in machine design. It is a repetition of the old struggle between the armor plate and the projectile. And while the armor plate, as symbolized by the metal cutting machines, is now generally supreme, its designers see danger ahead. There are indications that the new projectile—in other words new cutting materials—may make present machine equipment obsolete in many places.

Fortunately for all concerned, what appear to be revolutionary changes seldom come as quickly as seems likely at first. Carbon steel tools are still used on some work even though Mushet and the higher speed cutting tools made their appearance some forty years ago. In the same way we shall find the wonderful high speed steels of today —or better ones—in use in many places for a long period. There are still many shops where the present cutting tools are not effecting the economies that are easily possible by their use. And even if the newer cutting tools could be economically used in all classes of work, it would be years before the change could be made.

With the possibilities of much higher speeds, however, the designers of metal cutting machines must be alert to the demands likely to be made on them. They must know what the new cutting tools can do and how much more power and strength they must put into machines to utilize the full capacity of the tools.

There is also another phase of the question to be considered—the probability of cutting metals that are now machined only by using an abrasive. Manganese and materials that make cutting with present day tools impracticable, even if possible, may become a machineable material with the new cutting tools. If so, it will mean a re-alignment of machining operations by giving the cutting machines a chance at work at present beyond their reach.

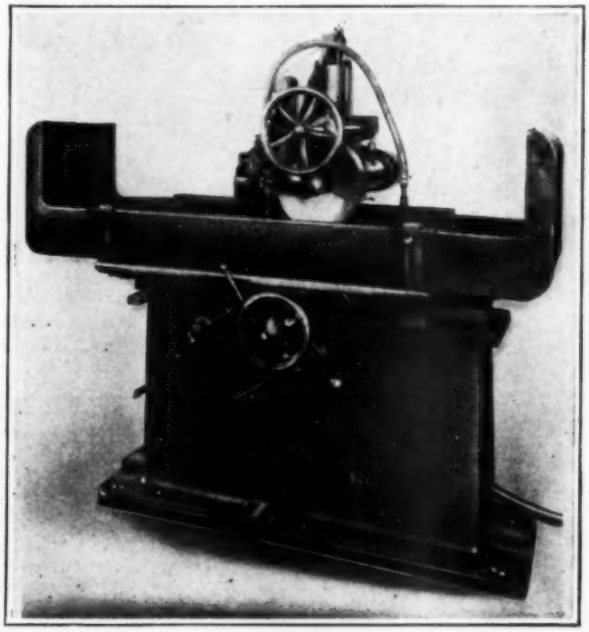
Whatever the outcome it behooves all to consider the possibility of much higher speeds on some classes of work.

· SHOP · EQUIPMENT · NEWS ·

Diamond Type F Surface Grinding Machine

WORK 24 in. long, 12 in. wide, and 12 in. high can be finished under a 12-in. wheel on the Type F surface grinding machine, which has been placed on the market by the Diamond Machine Company, Providence, R. I. As shown in the illustration, the guards are adjustable for the wear of the wheel and can be removed quickly. The wheel used is 12 in. in diam., has 1½-in. face, and 1½-in. hole. Feeds are as follows: Cross, automatic, 0.005 in. to 0.111 in. per stroke; hand, 0.333 in. per rev. of the handwheel; vertical, 0.125 in. per rev. of the handwheel, the vertical distance being shown on a dial graduated to 0.001-in. spaces. One-piece construction features the bed and column, which are internally braced to secure rigidity. Three standard T-slots are provided on the table, which is driven through a pinion that meshes with a one-piece rack. The head upright is so designed that its weight is carried on the broad column ways, and alignment is secured by the use of narrow innerways and a taper gib. Two long bronze split bearings, tapered on the outside circumference, support the spindle, which is hardened and ground to size. The spindle speed is 1,740 r.p.m. The bronze bearings are centered on their outer ends and fit into cast-iron bushings, which in turn are fitted into the saddle and held by setscrews. For wear adjustment, steel nuts draw the bronze bearings further into the cast-iron bushings and compress them as required.

The saddle is carried on the head upright by narrow dovetail ways and one flat way. It is held by a bronze taper gib on the dovetail, and by a flat gib on the rear flat way. Both spindle and table are driven by a 5-hp. standard a.c. or d.c. motor. Power is transmitted to the spindle through a silent chain and belt drive, and to the table driving mechanism through a silent chain, worm gear, and belt drive. The table travel is ample to clear work, and the speed of reciprocation is 29 ft. per min. Cross-feed may be either automatic at both ends of the table travel or by hand. The amount of feed is regulated by a variable-throw crank friction disk.

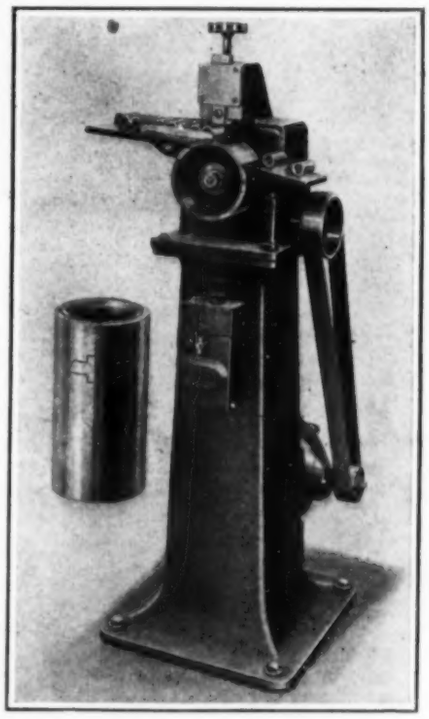


Diamond Type F Surface Grinding Machine

Operating controls include table and cross-feed levers and handwheels centrally located at the front of the machine. The length of the table travel is determined by adjustable dogs, but the table may be stopped instantly when desired. Hand and power feed cannot be engaged at the same time. The abrasive wheel is elevated by the handwheel through spiral gears, and the amount is shown by a dial graduated to thousandths of an inch. A powerful vertical-spindle centrifugal pump supplies ample coolant from a 30-gal. tank within the column. The coolant is delivered through movable nozzles to the work at any point. Troughs drain the coolant back into the sediment pan and to the supply tank. Splash guards are provided on the table to catch the spray. A magnetic chuck can be furnished extra. The length of the bed is 52 in., the height from the floor to the top of the table is 34⅝ in., and the floor space required is 66x106 in. The shipping weight is 5,300 pounds.

Noble & Westbrook No. 19 Rapid-Production Marking Machine

Sizes, trade marks, and other designs can be marked upon such round parts as piston pins, studs, bushings, or similar cylindrical pieces of various diameters and lengths on the No. 19 rapid-production marking machine, providing they have sufficient body to take an impression without crushing. The machine has been developed by the Noble & Westbrook Manufacturing Company, 20 Westbrook St., East Hartford, Conn. It is self-contained, and is driven by means of a ½-hp. motor. A loading platform and an apron to take the work from the machine are features,



Noble & Westbrook No. 19 Rapid-Production Marking Machine

and add to its usefulness. These are adjustable to take different sizes and parts. Power is applied to the feed roll through a special worm and gear, which runs in oil.

When the parts are to be marked, the operator places them in the proper position on the inclined chute. The action of the machine carries the parts to the marking die, and they are then thrown off automatically into a receptacle. The steel stamp is attached to the face of the small vertical slide, which may be seen at the top of the machine in the illustration. The stamp is set to a given diameter of work by adjustment through the handwheel at the top of the machine, and is locked in a position by a binding screw on the side. The adjustment may be used to make the impression lighter or heavier, or to set the stamp for another size of work. The face of the stamp is slightly concave to conform to the arc described by the outer surface of the work piece as it rolls under the die.

The capacity of the machine illustrated is for marking round pieces up to 1¼ in. in diam. Other ranges of sizes can be handled by the same machine by substituting different size feed rolls, and longer pieces by adjusting the outer retaining disks away from the feed roll. Production is quoted at 100 pieces or more per min. The weight of the machine with pedestal is 450 lb., and the floor space required is 18x24 inches.

Midwest Model S-H "Sinuous" Horizontal Air Filter

Capacity of from 3,000 to 3,500 cu.ft. per min. per cell, and an efficiency of from 96 to 99 per cent are the features of the Model S-H "Sinuous" air filters developed by the Midwest Air Filters, Inc., Bradford, Pa. Fig. 1 shows a large set-up having many cells, the magnified portion thereon showing an end view of the filtering medium.

The air enters from the bottom of each cell and passes through a short, straight passage, as shown from A to B in Fig. 2, to neutralize whatever swirls may exist in the air flow previous to its entering the filter medium. Next the air enters the convex portion B to C where the air flow is simultaneously bent and accelerated, and the inertia of the dust particles causes them to impinge upon the casing, which is flooded with "Viscosine." As the air rises from C to D, the flow is retarded, and the kinetic energy is transformed into pressure, which, in turn, is utilized for a second acceleration at the next bend at D. Between the points A to E, the combined and consecutive actions of retardation, bending and acceleration, cause the dust particles to be thrown out of the air stream by their own inertia and to be caught on the film of Viscosine.

The cycle is completed during the remainder of the travel through the medium, where the airflow is again retarded, the kinetic energy being regained as pressure. The energy used in accelerating the airflow is not dissipated, but is regained by application of the venturi principle, and is transmitted unimpaired to the outer air stream. The resistance of the filter is 0.25 in., water gage, and the size

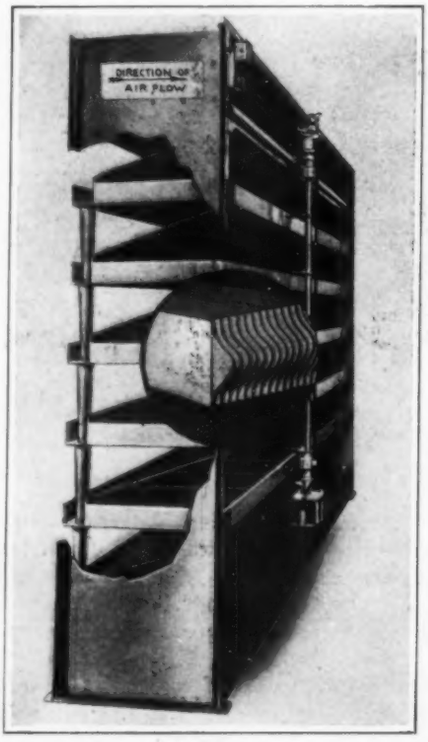


Fig. 1—Midwest Model S-H "Sinuous" Air Filter Installation with magnified cross-section of a filter cell

of the cell is 29x19⅝x3⅛ in. A sufficient number of cells can be utilized to provide capacity as high as 240,000 cu.ft. per min. in a space 17 ft. 7½ in. wide by 14 ft. 5 in. high.

Cleaning of the model illustrated in Fig. 1 is done by means of Viscosine

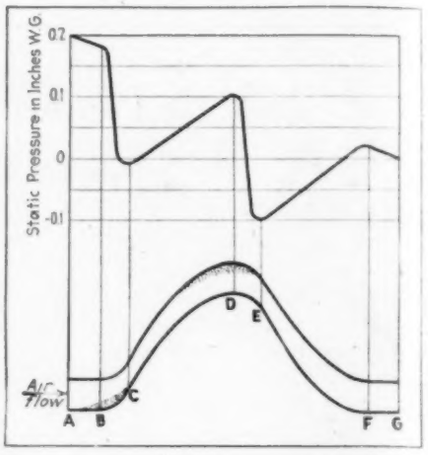
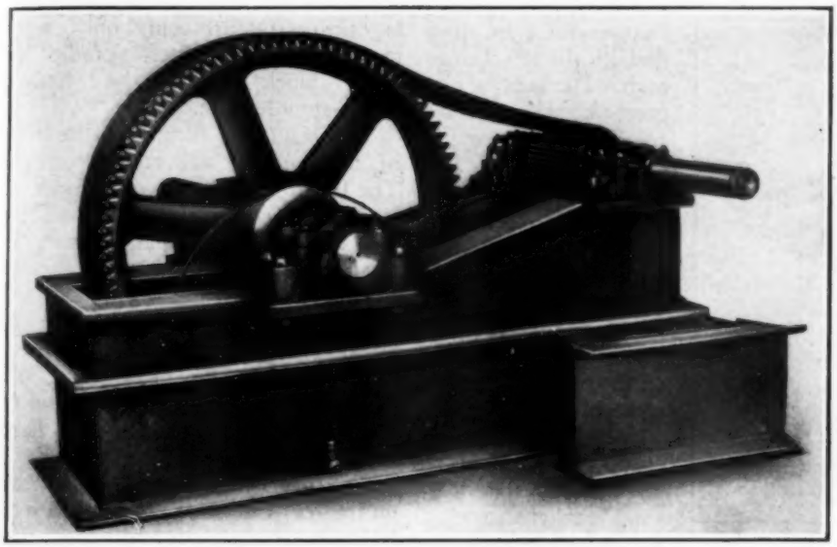


Fig. 2—Pressure diagram at air velocity of 1,000 ft. per min. The path of flow is shown horizontally for convenience

fed through flooding pipes, which travel over the cells at a speed of 8 in. per min. The flood pipes are connected to a header, containing a valve with ports opening automatically and in sequence into the different flood pipes. By flooding one row at a time, only a ¼-hp. motor is required for the pump. Cleaning and charging the plates, of course, is simultaneous. The dirty oil flows down the baffle plates into a collecting trough and thence into a settling tank.

Morse Silent-Chain Speed Reducers

Ability to absorb shock and ease of changing the speed ratios are features claimed for the silent-chain speed reducers, manufactured by the Morse Chain Company, Ithaca, N. Y. A large-size reducer is illustrated. The feature is a ring oiler, which supplies oil to a reservoir, from which it flows by gravity to a distributor that drops oil on the inside of the chain as it passes below the sprockets. Both single- and double-reduction units are built, the double-reduction unit consisting of either two chain drives in series or a single chain drive with a spur gear drive. The single-reduction speed reducers can be designed to transmit up to the maximum amount of power that can be transmitted with a chain drive, according to the manufacturer. The range of maximum horsepowers that can be transmitted at various speeds, when designed for favorable conditions, is as follows: At 3,400 r.p.m., 5 hp.



Morse Silent-Chain Speed Reducer shown with cover removed Lubrication is effected by means of the ring oiler

can be transmitted, while for 250 r.p.m., 1,000 hp. can be transmitted.

The drive consists of a steel driving sprocket, a cast-iron driven sprocket, and the silent chain. The sprockets are mounted on machined steel shafts, which run in either roller bearings or plain bearings at the option of the purchaser. The bearings are mounted either in pillow blocks, which are bolted to the main cast-iron frame, or in thimbles inserted in machined holes in the frame. One end of each shaft projects through the housing, and is arranged to take one-half of a flexible coupling. Lubrication of the chains and bearings is automatic. In the smaller units the chain dips into a bath of oil, whereas in the larger units a ring oiler, as shown, is provided. Speed reductions up to ratios of 10 to 1 can be supplied, though for ratios more than 7 to 1 a double-reduction unit is usually recommended. The drive has an efficiency of 98.6 per cent.

Defiance Two-Way-Opposed, Motor-Driven, Horizontal, Axle Boring Machine

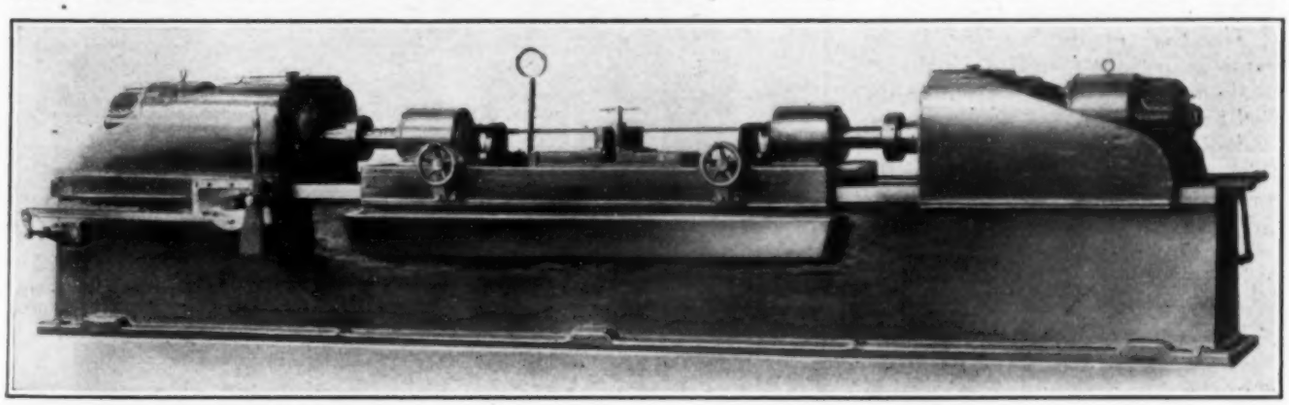
HEAVY boring, reaming, drilling, tapping, and other similar operations on automobile axles can be performed on this special two-way-opposed machine, which has been developed by the Defiance Machine Works, Defiance, Ohio. The base of the machine has been made exceptionally heavy and rigid with a cored center. It has heavy broad ways on which the heads slide, and which also support the fixture in the center of the machine. The axle borer can be equipped with Oilgear feed and pump, or with mechanical feed having rapid power approach to work, feed at desired rate, automatic kick-off, and automatic rapid return.

The machine can be built with single-spindle heads, or with as many spindles as desired. The spindles are made from alloy steel and run in anti-friction bearings or bronze bearings. They are driven with stub-tooth, heat-treated gears, inclosed and continuously oiled by either splash or force-feed lubrication. Each head on the machine shown is driven with separate 5-hp. motors running at 1,200 r.p.m., and a 3-hp. motor running at 900 r.p.m. is used for driving the Oilgear pump. The length of bed, height of spindle centers, number of spindles in each head, and the fixture are selected to suit the particular requirements.

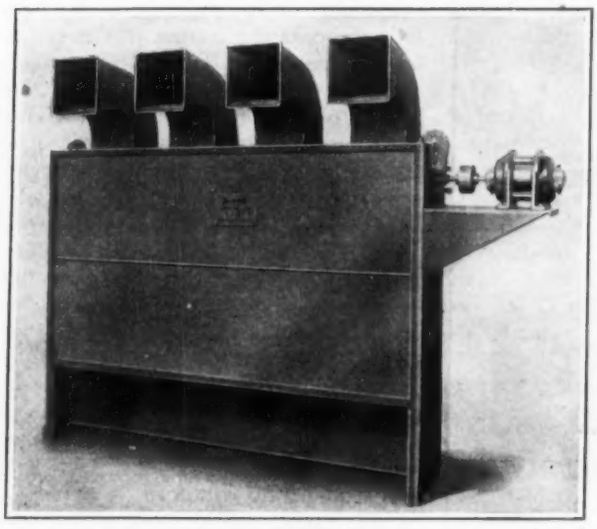
In the model illustrated the floor space occupied is 228x64 in., and the weight 18,170 lb. net.

"Sirocco" Unit Heaters

Industrial unit heaters for floor and ceiling application, both high- and low-pressure types, are now being marketed by the American Blower Corporation, Detroit, Mich., under the trade name of "Sirocco." The fan assembly consists of a battery of duplicate double-inlet Sirocco fans mounted on a structural steel top panel. The fans are supported from the top panel by means of brackets. Removal of the entire battery of fans with the shaft and bearings from the assembled heater can be effected. The shaft, on which the fans are



Defiance Two-Way-Opposed, Motor-Driven, Horizontal, Axle Boring Machine



Sirocco Unit Heater

mounted, is key-seated to receive a flexible coupling.

The heating element is composed of staggered rows of copper fin tubes expanded into one-piece cast-iron headers, the copper tubes being ¾-in. in outside diam. with a flat, continuous fin ¾ in. deep metallically attached to each. The heating element, having four rows of tubes deep, is supplied for low- and medium-pressure operation. One with three rows of tubes is ordinarily furnished for high-pressure installations, although the four-row type may be used if desired. The units can be furnished with pipe-coil heating elements. The motor is supported on a sheet-steel bracket in such a manner as to be accessible for inspection and oiling. Both the motor and fan shafts are mounted upon self-aligning ball bearings, and the bearings are supported in cast-steel brackets. A "Mercoid" thermostat can be arranged to start and stop the motor. The unit can also be used to ventilate.

Producto-Matic No. 25-Keyway-Cutting Machine

AN ADAPTATION of the Producto-Matic to the automatic cutting of keyways in automobile axle shafts is shown in the illustration, and is being placed on the market by the Producto Machine Company, Bridgeport, Conn. The machine cuts four tapered keyways at a time, and the operator loads and unloads the axles during the cutting cycle so that the only time lost between cuts is for the indexing. The rated production of the machine with one operator is 200 to 225 shafts per hour.

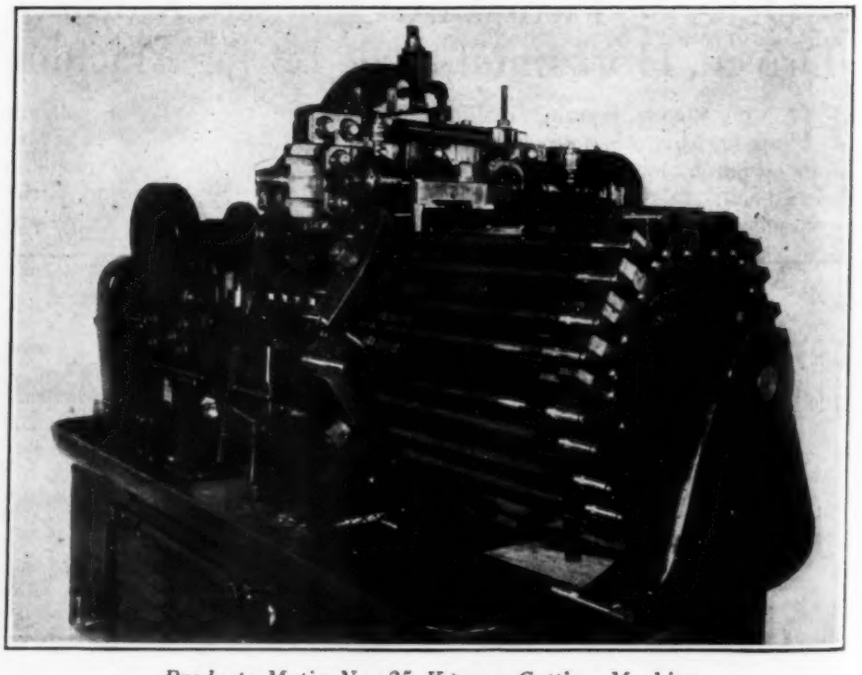
The base of the machine is the same as for the standard Producto-Matic machines, but the front of the bed has been cut off to permit the installation of the horizontal fixture. The camshaft drive at the rear of the machine and the cutter spindle drive are standard. Changes in speeds are made through pick-off gears in the drive boxes as described on page 559, Vol. 69, of the *American Machinist*.

The ram and slides are mounted on the rear of the bed. The horizontal movement of the ram is controlled by a box type of stroke cam on the rear camshaft, and the vertical slide is operated by a rise cam on the camshaft. The combined action of these two cams permits taking the tapered or bevel cut. This construction is an original feature found only on this machine. The cutter spindle and cutter block are of the standard single-spindle type.

The head and fixture at the front of the machine are entirely special. The fixture is of hexagonal form, designed to accommodate 24 axles. The headstock and the end support are mounted on heavy ball bearings. Springs are provided in the end support for holding in the axles so that the operator has both hands free for clamping down the head ends. The clamps are of hardened steel, and the heavy clamping bolts also are hardened. The indexing and locking of the fixture is governed by two cams on the rear camshaft operating a locking plunger and indexing lever.

As the machine is working, the operator inserts four axles on the side of the fixture presented to him. The axles are held in place by the springs on the end, and are then clamped at the keyway end by the hand clamps. The fixture is then indexed automatically to the cutting position at the top. The movement of the cutter spindle is entirely automatic, the cutters dropping to the cutting level, advancing at the proper angle, rising rapidly out of the work, and returning clear of the work to the original position while the fixture is indexing.

All wearing surfaces and seats of the fixture are hardened and ground.



Producto-Matic No. 25 Keyway-Cutting Machine

Ball and roller bearings are employed throughout the machine except for the cutter-spindle bearings, which are of the bronze taper take-up type. Force-feed lubrication is provided, with sight-feed oilers on the spindle bearings and slides. The standard tanks in the cabinet base are provided for lubricant and cutting compound. The machine is driven by a 10-hp. motor located in the cabinet base.

Baker Type D-96 Articulated Tilting Truck

An electric storage battery truck known as the type D-96, which will load 10-ton packages of sheet steel into box cars without breaking through the car floors, has been placed on the market by the Baker-Raulang Company, West 80th St., Cleveland, Ohio. The truck is hinged in the center, thus enabling it to make a very short turn from the loading dock through a 6-ft. car door with a package as large as 48 x 102 in. Sheets, which are to be handled, should be provided with 2x4-in. wood skids and firmly strapped together. The truck will pick up such a package from the floor, but, in order to handle the maximum tonnage, it is recommended that the packages be placed on the truck platform by means of an overhead crane.

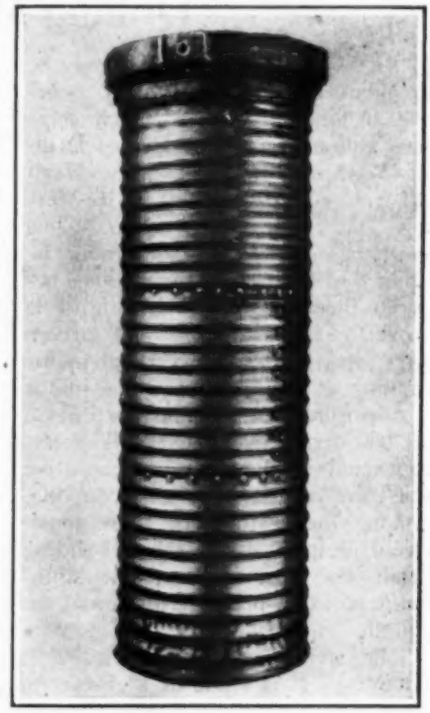
The steel is usually weighed just before it is loaded, and when the crane picks it up from the scale, the truck platform is run underneath. The truck then carries the load from the scale and places it in the car. Under such conditions, and making ample allowance for delays, the truck will load approximately 500 tons of sheet in a 10-hour day, putting a package weighing from 6 to 10 tons into a car in from 10 to 12 min. Such handling prevents the scratching of polished sheets, which usually takes place when transferred by hand.

In operation the truck is driven into the car with the load ahead. The platform is tilted until the rollers and wheels are all in contact with the car floor, thereby distributing the load so that the wheels will not break through the floor. With the platform tilted, the package is prevented from slipping by the winch cables. The truck next moves to the end of the car, and the package is allowed to slide from the platform, the operator slacking up on the winch cables. As soon as the package comes into contact with the car floor, the truck brake is released, and the cables are paid out further. The weight of the package slides the truck out from under the load. Guide strips are slipped under the package and nailed to the floor alongside the skids so as to permit the package to slide freely lengthwise of the car, but to prevent its shifting sidewise. Sheets larger than 48x102 in. can be handled, but automobile cars with 10-ft. door widths are required. The same truck may be used for unloading the cars, the cables pulling the package up onto the truck platform.

The power section of the truck carries the battery and the driving and steering apparatus. The load section consists of a tilting platform mounted on a single axle, and includes the hoist for tilting the platform and a double-drum power winch. Easy operation is a feature.

"Fuzon" Stainless-Steel Annealing Pot

After having been in and out of the furnace for approximately 75 times, according to the manufacturer, the "Fuzon" stainless-steel annealing pot had no cracks at the welds and no scaling had taken place, indicating that unusually long life might be expected. It has been developed by the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Because of the sheet-steel construction, the pot weighs but 660 lb., although 7 ft. high and 24 in. in diam.



"Fuzon" Stainless-Steel Annealing Pot

Baker Type D-96 Articulated Tilting Truck

As cast-steel pots frequently weigh several thousand pounds, it is evident that a large amount of heat may be saved during operation of the Fuzon pot, because of its light weight.

The shell of the Fuzon pot is made of 14-gage stainless iron containing 18 per cent chromium and 8 per cent nickel. It has a wrought steel base $\frac{7}{8}$ in. thick and a wrought steel collar on the top about 1 in. in thickness. Eight $\frac{1}{2}$-in. carbon-steel rods are welded to the collar and to the base-plate to take the strain. A steel plate is welded inside of the pot so that the coils of wire can be removed easily, and not be caught on the corrugations of the outside shell. The shell is first formed and riveted, the riveting being primarily for the purpose of retaining the proper shape and not to afford extra strength. It has been found in practice that the welds have sufficient ductility to take care of the difference in expansion and contraction between the parts.

Demco Model K Sensitive Drilling Machines

FROM one to six spindles may be obtained on the Model K sensitive drilling machines, which have been announced by the Demco Drilling Machines, Division of the Merit Oil Equipment Company, 6616 Morgan Ave., Cleveland, Ohio. The overhang of the spindles may be either 8 or 12 in., and the distance between them is $9\frac{1}{2}$ in. In Fig. 1 is shown a single-spindle unit driven direct by means of a vertical motor running at 1,200 r.p.m. The motor is substituted for the gearbox unit on the belt-driven machine, and is direct-connected to the rear vertical drive shaft by means of a slip coupling. Among the features of these sensitive drilling machines are: the sliding head, the belt shifter, the automatic constant-pressure idler, and the spindle.

The spindle shown in Fig. 2 is patented. It is made of high-carbon steel, accurately ground and balanced, and is provided with two driving splines. Ball bearings are used, automatically compensated for wear by means of a spring. The bearings are housed in a dust-proof quill, and are held in position by the upward pressure of the steel spring. Because of this feature, the spindle cannot drop because of its own weight when the operator is through drilling. The spindle is held in a sliding head, which has a long adjustable spindle bearing, and is securely clamped to the column by means of a single handle. The head unit is counter-balanced. Another feature is that the lever for the hand-feeding spindle is adjustable.

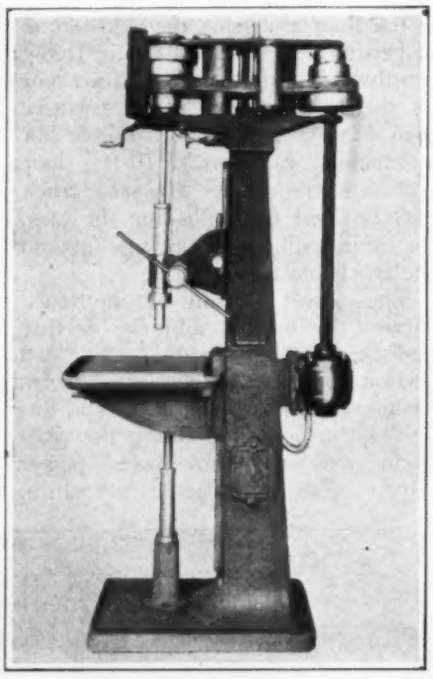


Fig. 1—Demco Model K Single-Spindle Motor-Driven Sensitive Drill

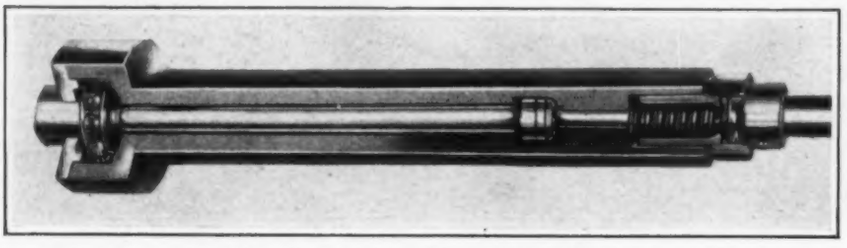


Fig. 2—Cut-away view of the spindle

A one-piece top bracket, braced both front and rear, contains the bearings for the front and rear cones, and also houses the belt-shifting mechanism and the automatic belt-tension idler, each of which is a separate unit. An endless flat belt is used to transmit power from the drive-shaft cone to the spindle cone. The belt shifter has two forks, and is operated from the front of the machine through a small crank handle, one complete turn being necessary for changing each speed. A guard plate on the front of the bracket indicates the proper speed for the various size drills. The idler is under constant pressure against the belt, and this pressure is relieved automatically the moment the belt shift handle is turned. This motion is accomplished through a cam with a spring tension. Pressure on the belt can be adjusted by means of a small handwheel directly under the bracket, and the entire unit can be taken out by removing two screws. The cones and idler can be removed by lifting the respective bearing caps.

Driving Arrangements

Power for drive is received at the rear cone from the vertical shaft, which is inclosed in a steel tube. In the case of the belt-driven machine, the vertical drive shaft receives its power from a gearbox containing a pair of hardened steel spiral bevel gears. A single motor can be applied instead of the gearbox and pulley to each spindle of a multiple-spindle machine or a standard 1,200 r.p.m. motor may be mounted on a separate cast-iron bracket at the base of the pedestal to drive the spindles through a common jackshaft. The motor bracket is arranged to take up any slack in the belt. Snap switches are furnished on the motor drive units as standard equipment, and push-button control can be furnished. All revolving parts are balanced and equipped with standard annular and thrust bearings.

The base of the pedestal forms a lubricant tank, and a standard type of pump built into the rear drive shaft is provided. Return of the lubricant from the table is through a flexible tube. The table is well-ribbed, and has a long support on

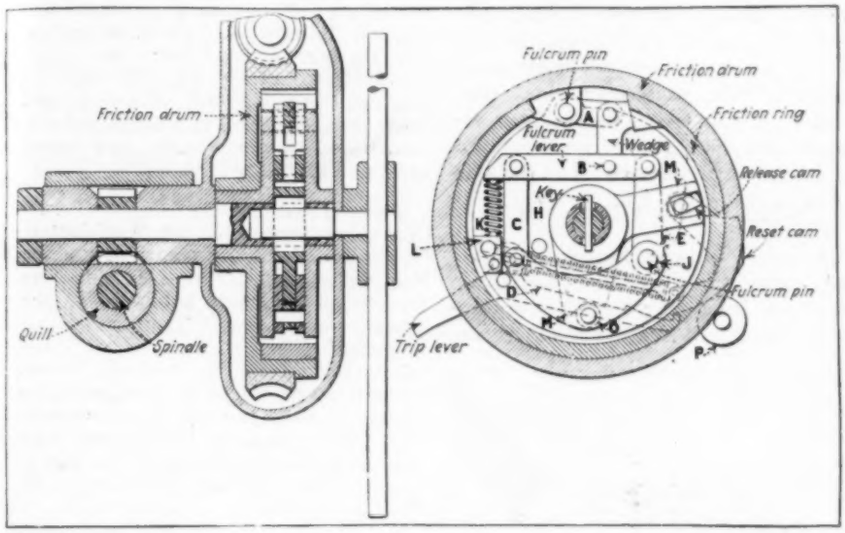


Fig. 3—Cross-section of the power-feed mechanism

the pedestal. It is raised or lowered by means of a telescopic screw. The controls are extended to the front.

Power feed to the spindle may be obtained as extra equipment. The expansion-ring type of friction clutch is illustrated in Fig. 3. Referring to this illustration, the expansion ring is forced apart by the wedge, which is connected to the fulcrum pin at the opposite end of the ring by means of the link *A*. The wedge is also connected to the fulcrum lever of a toggle by the pin *B*. The three links *C*, *D*, and *E* are the other links of the toggle, which is anchored to the plate *H* by the fulcrum pin *J*. The toggle is actuated by the spring *K*, which is anchored to the plate *H* by the lug *L*. Control of the mechanism is by the hand lever or the rest cam. The housing has a dial plate not shown. The depth to be drilled is set on the dial cover plate, and is locked. By turning the knob, the spindle feeds down until the trip lever comes in contact with the stop. Then the spindle returns instantly to the starting position, and if set for continuous action, immediately feeds down again. The spindle can be advanced or returned by hand while the power feed is in action.

"Vim" Portable Electric Tool

Among the applications of the "Vim" portable electric tool are driving wood and metal screws and nuts, drilling, grinding, tapping and buffing. The device has been developed by the Vim Tool Company, 149 Broadway, New York, N. Y. It is available in several styles in bench and suspended models.

The tool is provided with a clutch, which automatically engages when the bit or socket is applied to the work. Screw driver bits are made from special steel, heat-treated, and are quickly detachable. The tool is driven through a flexible shaft 6 ft. long from the suspended $\frac{1}{8}$-hp. motor. The motor can be applied to 110- or

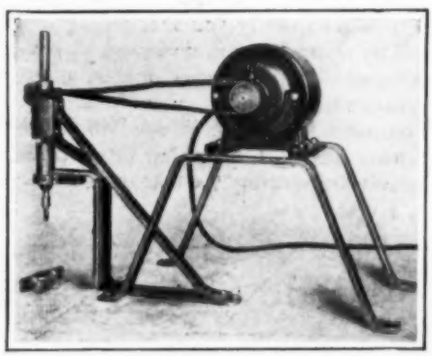


Fig. 1—"Vim" Type C Bench Model Screw and Nut Driving Machine

220-volt lines, and is a special series-wound universal type. It can be supplied with a contrivance for reverse action. The tool or hand piece has a ball thrust bearing, which carries the end thrust of the spindle and a coil spring that keeps the clutch disengaged while idling. Very little oiling is required on any of the models.

In Fig. 1 is shown Type C, which is a bench tool. The throat depth is $3\frac{3}{8}$ in., and it can be also made with a 6 in. clearance. The distance from the end of the bit to the base is 4 in. Wood and metal screws up to No. 10-32 are driven at 1,000 r.p.m. bit speed. The device is controlled from a pedal, thus leaving both hands free.

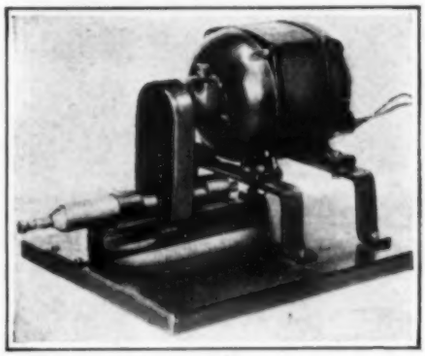


Fig. 2—"Vim" Type D Nut Driving Machine

In Fig. 2 the Type D bench machine is illustrated. This model will drive screws up to No. 6, and may be made in larger sizes if required.

Brown & Sharpe High-Speed, Vertical-Spindle Milling Attachments

Three vertical-spindle attachments, designed especially for high-speed work, have been placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I. They are known as the No. 10 high-speed, vertical-spindle plain, the No. 10 high-speed vertical-spindle compound, and the No. 10 high-speed universal milling attachments. The features are convenience of control, accuracy, and facility of application

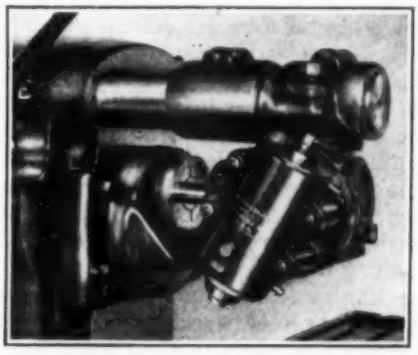


Fig. 1—Brown & Sharpe No. 10 High-Speed, Vertical-Spindle Compound Milling Attachment

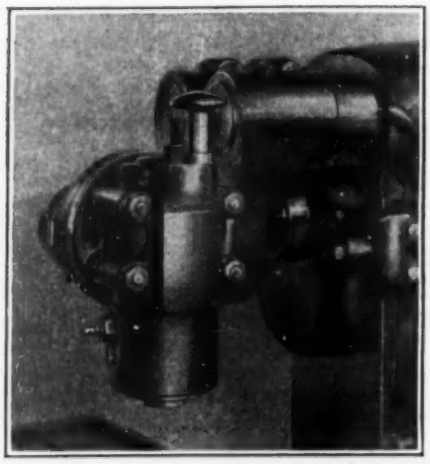


Fig. 2—Brown & Sharpe No. 10 High-Speed, Vertical-Spindle, Universal Milling Attachment

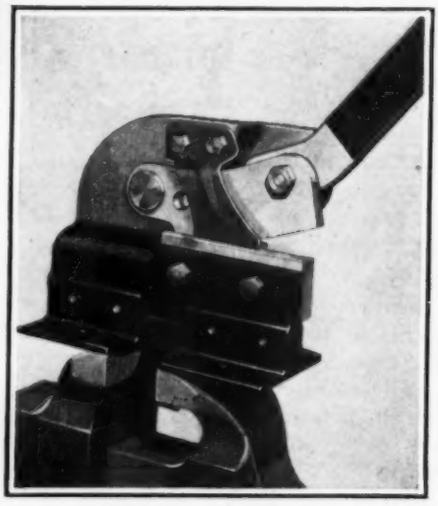
to constant-speed-drive, horizontal-spindle machines. Anti-friction bearings are used on the high-speed spindles.

The No. 10 high-speed, vertical-spindle, plain milling attachment is designed particularly for manufacturing jobs where it is desirable to raise the spindle to clear the cutter from the work, in order to facilitate loading. It is also suitable for milling keyways, slots and similar work, where it is desirable to feed the cutter into the work by hand before engaging the power feed of the table. The spindle is always in the vertical plane, and has a hand adjustment of 2½ in. Adjustable stops regulate the movement of the spindle when milling duplicate pieces.

The No. 10 high-speed, vertical-spindle compound milling attachment, shown in Fig. 1, with the exception of the high-speed spindle feature, is similar in design to the regular Brown & Sharpe compound attachment. This spindle may be set in a plane at right angles to the table for milling angular strips and table ways. With the spindle in this position, the full length of the table travel is available, and an ordinary end mill can be used for milling the angle. Full universal movement of the No. 10 high-speed vertical-spindle universal milling attachment affords a means for drilling, milling angular slots and surfaces, cutting racks, and milling dies, molds and other tool work. This attachment is provided with a hand-feed adjustment of 1½ in., which adapts it for angular boring or setting end mills into the work. All three styles of attachments are securely held in position by means of sturdy clamps. They can be used to adapt horizontal-spindle milling machines to work that usually is performed on a vertical-spindle machine.

"National" Vise Shear

Designed to be mounted in a vise lengthwise or crosswise, this vise shear has been developed by the National Machine Tool Company, Racine, Wis. It has a capacity for ⅛-in. flat stock and $\frac{5}{16}$x2-in. bars. The blades are made of tool steel and can be removed easily for sharpening.



"National" Vise Shear

The shear body is designed to permit easy slitting of wide sheets, and a $\frac{5}{16}$-in. rod cutter is also furnished. Compound leverage is used to make cutting easy. A patented taper latch permits mounting the shear securely in a vise.

Trade Catalogs

How to Take Inventory. The Barrett Bindery Co., 1328 West Monroe St., Chicago, Ill., has published a pamphlet entitled, "How to Take Inventory in Manufacturing Plants." The pamphlet gives the causes of error, the methods of procedure, and methods of summarizing and pricing. It also shows various inventory supplies.

Gears. The Boston Gear Works, Inc., Norfolk Downs, Mass., has published Catalog No. 48, containing listings of Boston standardized steel spur gears, cast-iron spur gears, brass and steel pinion rods, sheet brass spur gears, spur gears, worms and gears, sprockets and chains, lubricators, combination-type ball bearings, pillow blocks, self-aligning hangers, thrust washers and ball bearings, annular ball bearings, and other products. The catalog is indexed, contains many photographs and tables, and has 240, 6x3½-in. pages.

Gear Tester. The R. Y. Ferner Co., Investment Building, Washington, D. C., is distributing copies of catalog No. 458 entitled "Sip-Gear Testing Apparatus" which is published by the Société Genevoise D'Instruments de Physique, Geneva, Switzerland. The catalog discusses the various errors which may be found in gear teeth and the methods of testing for eccentricity and pitch. Several illustrations are used with the description of the operations. The catalog contains eight, 11x8½-in. pages.

Jacklift and Stacker Practice. The Lewis-Shepard Co., 165 Walnut St., Watertown Station, Boston, Mass., has published an illustrated pamphlet, which is the annual edition, known as "Jacklift and Stacker Practice." The pamphlet consists of a large sheet of illustrations of special-purpose lift trucks, special-purpose stackers, and standard equipment of both types. Views showing the various types in operation are also included. Suitable captions are employed with the cuts to explain the operation and construction.

Lighting Equipment. The Bart Manufacturing Co., 6,001 South Talman Ave., Chicago, Ill., has published a catalog on industrial portable lighting equipment. Among the types shown are machine and bench type lights, extension cord lights, flood lights and hand lamps. The catalog contains fifteen illustrated 6x3-in. pages.

Motors. The Century Electric Co., 1,806 Pine St., St. Louis, Mo., has published three catalog and engineering data loose-leaf sheets. Sheet 2-1 shows the construction of repulsion-start, induction, single-phase motors, Type RS, while Sheet 7-3 describes squirrel-cage, polyphase induction motors of three- and two-phase models, Type SC. Engineering data sheet 23-401 is concerned with the selection of motors and control.

Polyphase Induction Motors. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has published Bulletin No. 1,118-B entitled "Polyphase Induction Motors," in types "AR" and "ARY." These motors may be supplied with either sleeve or tapered roller bearings. The general construction is described and illustrated, and all of the important parts are shown. A special vertical type "ARYV" is also mentioned. Various types of starters and switches for control of these induction motors are listed. The catalog contains fifteen, 11x8½-in. pages.

NEWS OF THE WEEK

Want No Changes in Morse Taper Shanks

In a resolution adopted at a meeting held on November 9, members of the Drill and Reamer Society have gone on record as being unalterably opposed to any changes in the present Morse taper shank standards. This conclusion was reached after careful investigation, on the part of members of the society, of the suggested changes in such standards. The resolution stated that there is practically no indicated demand on the part of users for alterations in the present standards of all sizes; that there is no valid reason in sound engineering practice for such change; and that, as the present Morse standards are the only international standards and are in world-wide use, the utmost confusion, economic loss and expense to manufacturers, dealers and users would be involved in the presentation of any new standard in taper shanks. Furthermore, the resolution adds, the proposed changes tend to defeat the efforts of the manufacturers of small tools toward simplification of product.

Decline in German Machinery Industry

A further decline in the domestic German machinery business is evident from the statement for the month of September just issued by the German Machinery Manufacturers' Association *(Verein Deutscher Maschinenbau-Anstalten)*. The number of firms reporting an unsatisfactory number of inquiries increased by about 15 per cent as compared with August. Domestic orders also decreased, though to a smaller degree. Export business was not maintained at the August level, a much smaller number of foreign inquiries and orders being reported. Plant activity, as measured by the number of working hours, remained approximately the same as for the previous month, that is about 75 per cent of normal. The number of inquiries received by the material working machinery *(Werkzeugmaschinen)* manufacturers, however, is reported as being satisfactory both as regards the domestic and foreign markets.

The slowing up of business, which has been noticeable for some time in Germany, has fortunately not yet given any signs of leading to a real crisis, and industry in general has been making every effort to prevent such an occurrence. German manufacturers are being warned against increased production costs. When one compares the German Statistical Office's Index of machinery prices with the cost figures of the Association of German Machinery Manufacturers, it is noted that the increase in machinery prices since the beginning of this year has been only about 54 per cent of the increase in production costs. From this it can be seen that the relation of production costs to profits has become steadily worse since the first of the year. This situation is a source of concern to the German machinery industry, especially in view of the keen competition experienced from foreign manufacturers.

Net Profits of Industrials Up 11.97 Per Cent

Total net profits of 392 companies in twenty-one lines of industry and miscellaneous, amounted to $2,268,106,000 in the first nine months of 1928, compared with $2,043,491,000 in the corresponding period of 1927, an aggregate gain of 10.99 per cent, according to a compilation prepared by Ernst & Ernst, accountants, New York City, from published financial statements. Industrials lead the list with an increase of 19.17 per cent. Public Utilities follow with a gain of 11.97 per cent. A group of 125 railroads report an income, before certain charges but on a comparable basis, 3.02 per cent higher than in the same nine months of 1927. The average profit of twelve machinery companies rose 10.93 per cent, while 21 automobile part and accessory firms gained 50.10 per cent over the profits in the first nine months of last year. The gain for automotive manufacturers was 21.48 per cent. Manufacturers of railroad equipment, however, showed a loss in comparative income of 35.24 per cent.

Ludlum-Atlas Steel Merger Progressing

Special meetings of the stockholders of the Atlas Steel Corporation, of Dunkirk, N. Y., and of the Ludlum Steel Co., of Watervliet, N. Y., will vote on the consolidation of the concerns. If the vote is favorable, some plan of financing will be arranged to retire all of the present securities of both concerns standing ahead of the common stocks. The reason for the merger is the fact that additional facilities are required by the Ludlum firm for its own products as well as for a new series of chrome-nickel steels which are to be made under license of the Krupp Nirosta Co. In addition, the Ludlum directors have voted to expand facilities further to take care of a plant for the manufacture of tungsten carbide tools and dies under combined patents of the Krupp Works and the General Electric Co. The construction of this plant will begin at once. The directors of the Ludlum Steel Co. have also authorized the construction of a plant for the drawing of chrome-nickel steel by a German process for which Ludlum has the American rights.

Buffalo Forge Co. Now 50 Years Old

The Buffalo Forge Co., Buffalo, N. Y., is now celebrating its fiftieth anniversary. The concern started in Buffalo in 1878 when Charles F. Brunke and Chas. Hammelman began the manufacture of the portable forge originated by Mr. Hammelman. In 1884 the company entered the heating and ventilating field, and in 1903 the Geo. L. Squier Manufacturing Co. and the Buffalo Steam Pump Co. were acquired. The three firms grew until in 1914 the plants employed 1,500 men. H. W. Wendt is now president; E. F. Wendt, vice-president and treasurer; H. W. Wendt, Jr., vice-president and secretary, and C. A. Booth, vice-president and sales manager. Mr. H. W. Wendt is the brother of W. F. Wendt, who bought a half interest in the company in its first year, but who sold his interest to his brother eight years ago.

Southern Industrialists Consider Foreign Trade

The annual meeting of the Southeastern Foreign Trade Conference was held at the Biltmore Hotel in Atlanta the latter part of November, attended by prominent officials of the United States Department of Commerce, the Bureau of Foreign and Domestic Commerce, industrial trade associations, and manufacturers representing the keynote industries of the southern states. Representatives were also present from all of the South Atlantic and Gulf Coast port cities, as well as from several foreign markets. The foundry, machinery and metal trades industries were well represented at the meeting.

The primary topic discussed concerned the further development of export trade of Southern concerns with foreign markets, including financing of export sales, knowledge of world geography and foreign languages and methods as an aid to export sales, American investments abroad, etc. Dr. Guy King, Chattanooga, Tenn., formerly Cuban consul in Atlanta for some years during which time he increased foreign sales of Atlanta concerns to Cuba by several million dollars per year, particularly machinery, was elected president of the conference for 1929.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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DESPITE the fact that last week was shortened by Thanksgiving, the stock market boiled as furiously as ever, and continuance of the present rate of activity seems to be expected by the millions who have bought this, that, or the other security for a rise. Whether this expectation will be realized remains to be seen. Call money rose to 9 per cent on Tuesday. We are again commencing to export gold to Canada.

Most of the stock exchange houses are increasing their marginal requirements, and it may be that we are approaching a point at which credit will no longer be available for stock market operations. But only the academic students of financial history seem to appreciate this, and the great majority appear to think that prices will continue to advance indefinitely.

This is indicated by the preparations that the various commodity exchanges are making to deal in securities. The Chicago Board of Trade is planning to deal in stocks, as is the New York Produce Exchange. It is proposed to add a department to the New York Cotton Exchange where textile stocks and bonds can be bought and sold, and a department for trading in sugar securities is being considered by the New York Coffee and Sugar Exchange.

Meantime the minor stock exchanges of the country are enjoying a greatly increased business. The Chicago Stock Exchange has done the largest business in its history on a single day. Unusual activity prevails on the St. Louis Stock Exchange, and a seat on the Los Angeles Stock Exchange has sold at $175,000, which is nearly a third of the high record of $575,000 touched for a membership on the New York Stock Exchange last week.

The phenomenal character of the present speculation in stocks is eliciting the attention of economists all over the world. Their inability to explain it except as a psychological manifestation gives those who maintain that America is entering upon a new era an opportunity to reiterate their optimism and their belief in continued prosperity. They may be right, but the appreciation that has been recorded in the value of corporate securities during the last four or five years greatly exceeds the increase in our national wealth, and those who attach any importance to precedents will continue to believe that the advance has been overdone.

The rise in the value of Standard Oil Securities is a case in point. When the old Standard Oil Company was dissolved in 1911, the market value of its stock was about a billion dollars. It was split into about 33 companies, whose securities are now worth an aggregate of over five billion dollars. Most of these companies have paid handsome dividends in the interval, and it seems hard to believe that their worth has quintupled after allowing for depletion. The same statement applies to many other corporations, and the facts are submitted for the information of those who are disposed to consider them at a time when excitement is blinding many to the essential facts of the situation.

But while waiting for the stock boom to run its natural course, it is idle to deny the activity of legitimate trade, or the improvement in business that it connotes. Car loadings for the week ending November 17 were 9 per cent in excess of last year, and the October earnings of 51 major railway systems showed an increase of 23.7 per cent upon last year.

Rubber is about as it was, but the demand appears to be equal to the offerings, and the tire manufacturers are said to have been free buyers.

Industrial America seems to be running at or near capacity. The steel mills continue to be well employed. The automobile manufacturers are as optimistic as ever. Used cars are a little more difficult to dispose of as Christmas approaches, but dealers say that the market for secondhand vehicles is better organized than ever before in the history of the trade.

The "lame duck" Congress which convenes in Washington this week will have so many problems before it that it seems doubtful whether a solution of any of them can be effected. Among them are farm relief, the tariff, the Kellogg Treaty, inland waterways, railway consolidation, and the policy of the Federal Reserve Banks in their handling of the credit situation.

Of course, the illness of King George takes the first place in the foreign news of the week. America sympathizes with the British Empire in the apprehension felt for the stricken monarch, but the effect upon business has been negligible.

Elsewhere in Europe the outlook appears to be tranquil, and while the cables from China indicate that the Nationalistic Government is not yet firmly entrenched, it appears to be gaining in stability.

The week's news from Russia is also inconclusive, but there is less talk of a revolution and the Soviet Government is making energetic efforts to obtain the credit necessary to finance its foreign trade.

Taking all in all, and viewing the situation subjectively as well as objectively, the trend of business throughout the world would seem to be upward. This is particularly true of America. The only cloud upon the horizon is the distended condition of the stock market, and if it can be wisely and gradually deflated, 1929 ought to be a year of great prosperity in this country.

WHAT'S DOING IN INDUSTRY

CONSIDERABLE activity in the purchase of machine tools is reported in all centers but two in the past week. In Detroit there has been a decided slump, but no greater than anticipated, and sales are still well above what they were at this time last year. There has been a slackening up in the automotive industries, and employment has fallen, but is still high for this period. A decline in the local market is reported in Cleveland also, but a resumption in buying is expected after the first of the year.

CINCINNATI, on the other hand, reports an excellent volume of sales, and the machine tool builders there are more optimistic than at any time since 1920. The volume and tone of inquiries indicate that this activity will continue for some time. In Milwaukee the situation of the trade is about as favorable as at any time since the War. As in many other centers, however, there is a shortage of skilled help, and the tool builders are behind in deliveries.

IN CHICAGO, business in this line becomes increasingly better as the year draws to a close. November sales overshadowed those of October, which was a record month. November has also been a good month in the New England market. The Philadelphia market, rather spotty during the early fall, is now quite brisk and it is reported there that builders are increasing their capacity in anticipation of continued orders.

IN ALL centers, a large volume of well-scattered orders is being maintained, with only an occasional large list, indicating a healthy condition in industry.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CLEVELAND

Owing to the proximity of the holiday season and the nearness of inventory time, a decline in sales of machine tools was noticeable in the local machine tool market during the past week. Business, however, is above the average for this time of the year. Inquiries are holding up and a general resumption of buying after the first of the new year is predicted.

Business in the automatic lines continues active despite the slowing up in the other branches of the industry. Sales for November have averaged as good as October and September. Inquiries continue in goodly number. The outstanding feature of this division was the booking of the largest order for production machine tools recorded in local machine tool circles since the War. The National Acme Co., through President F. H. Chapin, announced that an order for ten of the largest automatic screw machines was received by radio-telephone from its branch office at Stockholm, Sweden, for immediate delivery.

DETROIT

The market here has experienced a decided slump within the past few weeks, but it is no greater than the machinery and machine tool dealers had expected, and it is more or less fortunate in that it gives most of them an opportunity to catch up on deliveries. In many cases, particularly with some of the specialized equipment, orders were several months ahead of the deliveries.

The automobile industry is, of course, slacking up in preparation for the bringing out of new models. Employment has dropped regularly during the past few weeks but is still higher, by many thousands, than it was at this time last year and higher even than it was at this time in 1926, a very good year.

Most of the dealers predict that 1929 will be an even better year than the last one. They are convinced that the present drop is purely a seasonal one and that all of the signs point to a resumption of automobile manufacture that will eclipse all other years. General business is extremely good in almost all lines.

CINCINNATI

Taking the machine tool industry of the Cincinnati district as a whole, the past week's sales were excellent, with the same good daily average as in the previous week. The great majority of the manufacturers report that there was little if any change in the demand, and any small decrease in sales that a few may have had in the period was offset by increases of others.

"The present activity of the market is wholly unexpected," explained one manufacturer, and others expressed the same thought in different words. Basing their opinion on the nature and tone of the inquiries that are coming in, even the most conservative of the manufacturers express a feeling that the market will continue as it is, or grow still better.

The greater part of the week's business consisted of orders for single tools and replacements. The principal buyers were general machinists and miscellaneous users, located in all sections of the country, and their requirements were well diversified in the matters of sizes and types. Sales to concerns in the automotive industry were confined to single tools, and the same was the case with the railroads.

An excellent volume of inquiries were received in the week by manufacturers, the great majority of them being from general machinists and miscellaneous users. The inquiries were well scattered over the country and the requirements were well diversified. A good-sized list of requirements came from the Southern Railroad, and several smaller lists came from other fields.

CHICAGO

Business in the machine tool industry grows increasingly better as the year draws to a close. It had been thought that the month of October would constitute a record breaker in point of the volume of business transacted, but it has been overshadowed by November in this respect. District representatives of a number of machinery building concerns report their plants as being swamped with orders. All are working overtime, and several are hampered in production by reason of the deficiency in skilled machinist labor. In the matter of deliveries, the setting of definite dates is declared to be impossible under present conditions.

The prospects looking toward railroad business in machine tools for 1929 do not appear to warrant much optimism. The local representative of an Eastern house which specializes in the manufacture of railroad machinery equipment states that there seems to be no probability of an increase in railroad buying, at least during the early part of 1929. Such budgets as at this time are being prepared for next year by the Western lines, while of course including necessary tools, for replacement or otherwise, are said to be closely restricted with respect to quantity.

Business in used tools is being maintained on a very satisfactory level according to all reports.

NEW ENGLAND

November was a good month for machinery builders in the New England territory. It is certain a number of Massachusetts manufacturers had their best month of the year from an order standpoint. This is also applicable to used and rebuilt equipment dealers. Some items in this field are being turned over with a very narrow margin of profit, however.

The New England territory is booking many orders for a variety of small tools and machines. As in previous months this volume of lesser machines makes up a large part of the business placed. Most plants have a large unfilled order balance and a correspondingly heavy stock of raw material.

The closing weeks of November disclosed some larger lists. A central Connecticut company has just closed on three orders, each calling for more than a dozen machines. These include jig boring, surface grinding, drilling and die sinking units, as well as a variety of lathes. A Massachusetts shipbuilding concern has had a list calling for 10 or 15 tools in circulation for some time. A Springfield automobile manufacturer has placed a list of a dozen items. A western Connecticut manufacturer has received some substantial November orders for lathes.

PHILADELPHIA

Philadelphia producers and dealers reported a brisk business throughout the market during the last two weeks. Sales agents and dealers reported a busy period, with expectations for a continued period of activity.

A noticeable feature of the last fortnight as reported by dealers was that machinery dealers are preparing for a permanent period of good business by acquiring modern equipment to meet the demands for speed that have come from many industrial lines. One of the difficult problems confronted by producers is meeting the demands for early delivery.

The sales during the last two weeks were for diversified lines, with lathes, shapers and turret lathes in the list of sales. The Atwater Kent Co. entered this market for some moderate purchases, and there were some sales to automobile factories, and some railroad buying.

Officials of the Baldwin Locomotive Works said they expect soon to increase their percentage of operation above the present 20 per cent of capacity. Information reaching some of the Baldwin officials is that the railroads soon are to make some extensive purchases of engines. The company has begun the delivery of an order of oil-burning locomotives for the Southern Pacific Railroad.

Most of the machine shops in this area are operating at virtually full capacity, and many of them find it difficult to obtain skilled workers.

MILWAUKEE

The situation of the metal-working equipment trade at the beginning of December averages about as favorably as at this period in any year since the war, and it is infinitely better than it was a year ago, with all indications pointing to a continuance of a good demand for tools. November proved to be a satisfactory month in respect to the volume of bookings, and with inquiry growing more active, December business likewise is expected to reach a very satisfactory total. Orders are coming from a broadly diversified field and practically every line of metal products manufacture is represented.

With a demand so good and of such insistence as it is, production problems of machine tool plants have found no relief, the shortage of skilled men remaining acute. Little progress has been made by most plants in catching up with deliveries, despite their strenuous efforts to accomplish this object by running overtime.

The outlook for 1929 is viewed hopefully by all makers of tools and while, of course, it is too early to make predictions, it is generally felt that the situation is so sound that the present buying movement, together with the normal replacement requirements of industries, will continue to keep the tool industry busy for some time to come. Despite the relatively heavy purchases of machinery by aircraft concerns this year, it is believed that only the surface has been scratched. Hope also is expressed that the railroads will become a much more important factor in the trade during the coming year to give bulk to the demand.

NEW YORK

No outstanding orders, such as the large one placed by the Wright Aeronautical Corporation last week, were noted this week, but in general a good volume of well-scattered orders continued to be received. In

some cases a slight decrease in activity was noted, but the majority of dealers and factory representatives were enthusiastic about the present trend. There is much business outstanding which is expected to be closed in December, so that the year should finish up with a flourish. Because of the Wright orders, November was a good month for many, in one case two and a half times normal.

Additional scattering orders were received from Wright during the week. The New York Central R.R. bought some tools and is expected to close on others in the near future.

Sales made by the Triplex Machine Tool Co. included: five Springfield lathes, one Swiss jig borer, two drill presses, two Arter rotary surface grinders, one sensitive radial drill, two hand millers, and a miscellaneous quantity of small tools. These orders bring the November volume above normal, and considerable December sales are anticipated.

The Pratt & Whitney Co. reports the sale of: One No. 3 bench miller, three 7-in. bench lathes, three 14-in. vertical surface grinders, five jig borers, six 13-in. lathes, four 16-in. lathes, two die sinkers and three 4½-in. thread millers. The Niles Tool Works Co. sold a 100-ton bushing press, a 5,000-lb. steam hammer, and a 36-44-in. side head boring mill to a railroad in the Middle West. The company also sold two 4-spindle drum millers and a 44-in. heavy boring mill. The machinery division sold a 6-ft. Morris radial drill, a No. 1A Long & Allstatter punch and shear, a Racine hacksaw, a 22-in. Aurora drill, and a No. 108 Ransom grinder.

BUFFALO

In the machine tool field some improvement is noted over the first half of November but still business is not as good as it was in the late summer and early fall, according to reports of most dealers. There seems to be a general feeling now that conditions will continue rather quiet until after the first week in January after which a brisk resumption of buying is generally expected.

In the electrical field, demand seems slightly more brisk than in the general machine tool field. However, this will doubtless improve after the holidays. Business in the contractors' equipment field here seems to be going through one of its periodical and seasonal slumps, but this will doubtless improve with the first heavy fall of snow.

International Aircraft Exhibit in London in 1929

An international exhibition of aircraft is planned to be held next year in London, according to the Department of Commerce. Maj. C. M. Young, director of aeronautics for the Department, states that the chairman of the Joint Committee and of the Society of British Aircraft Constructors, Ltd., announce the aircraft exhibition for July 16-27, to be held at Olympia. The international exhibition is to be fully representative of all phases of aeronautics, according to preliminary announcement of the British chairman.

Insurance Ruling Dissapproved in the South

An important decision affecting many of the foundry, machinery and metal trades plants of Georgia and the South was given the latter part of November by William A. Wright, insurance commissioner for Georgia. At a hearing in Atlanta Nov. 15 an effort was made by several insurance concerns carrying workmen's compensation to add a special surtax of $10 to premiums of all insurers paying less than $300 per year in premiums, while a further effort was made to include salaries of executive officials and directors of corporations in payroll computation for premium purposes. After hearing the evidence of both sides, the insurance commissioner ruled later that he disapproved of both these proposals. Several individual concerns and associations opposed these proposals at the hearing, including the Georgia Manufacturers Association, of which most of the foundries, machine shops and metal trades concerns in Georgia are members.

Czechoslavakian Machinery Situation Improves

Czechoslovak exports of machinery during the first eight months of 1928 exceeded those of the same period of 1927 by 9,615 tons at a value increased by $2,897,419. With the exception of the month of February of 1928, the other months showed increases over those in 1927. Czechoslovakia imported 22,974 tons of machinery worth $12,086,707 during the first eight months of 1928. Exports exceeded imports by 16,757 tons, but the value of exports was $2,622,876 below the value of imports. Imports of machinery in 1928 compared with those of 1927 show increases in every month, the total number of tons imported exceeding the 1927 imports by 8,901 tons at a value increased by $4,554,073. Manufacturers are continuing to modernize their plants and are introducing standardization in order to meet competition. The most modern machinery is therefore imported and special machinery, not as yet manufactured locally, is still in great demand.

Aeronautical Notes

Development of a new airplane engine has been announced by Louis Chevrolet, head of the Chevrolet Aircraft Corporation, Indianapolis, Ind., and designer of the motor. It is to be built under his supervision at the plant of the Merz Engineering Co., which also has developed an 8-cylinder aircraft engine. The Chevrolet engine is a vertical, 4-cylinder in line air-cooled type, developing 80 hp. and weighing under 300 pounds.

Incorporation of the Douglas Aircraft Company, Inc., to acquire the business and assets of the Douglas Co., Santa Monica, Calif., is announced by Donald W. Douglas, president. New capital has been obtained and several Eastern and Pacific Coast bankers have been added to the board of directors. E. A. Pierce & Co. and Blair & Co., Inc., are announced as bankers for the company. There will be no change in the management of the concern. Heretofore the Douglas Co.., which was organized eight years ago, has confined its operations chiefly to the building of planes for the United States Army, Navy and Postoffice Department and for foreign governments. The new company will also build commercial planes.

Labor Troubles Menace Industrial Germany

By Our Berlin Correspondent

THE labor conflict in the metallurgical and machine building industry of the Ruhr district has laid bare one of the most vulnerable spots in Germany's industrial armor. It is now an admitted fact, that the post-war German system of settling labor disputes by so-called collective wage tariffs under governmental arbitration is a failure.

The procedure is briefly the following: Working conditions are settled between the organizations of employers and employees by tariff agreements, usually concluded for one year. When such an agreement expires, through notice being given by either side, both parties meet and negotiate for a renewal. If they dissent, the board of conciliation steps in, directed by the public arbitrator of the district whose decision can be, and is mostly, made compulsory.

This system, born in Germany's times of storm and stress hardly leaves a loophole for open conflicts, like strikes or lock-outs. Labor and employers have to abide by the decision of the arbitrator whether satisfied or not. If dissatisfaction of the workmen ends in a strike, the latter is "illegal." The unions are in this case prohibited to pay subsidies and the employers gain a free hand to retaliate against the strikers at will. On the other hand they are not allowed simply to shut down their works, if they find that through a decision of an arbitrator, they are unable to continue operations at a profitable basis. In the Ruhr district, the demobilization orders, still in force, require in such cases from the employers a six months' notice.

Admirable as this system seems to be, apparently guaranteeing an unbroken peace between employers and employees, and a long stretch of stable wages, it has in practice been found very costly not only to the owners but to the economic life of Germany in general. When a wages agreement expires the unions invariably come forward with new claims. Their avowed aim is to keep wages in constant upward motion. In 98 cases out of 100 the arbitrators have in the last 4 years decided in favor of the unions' claims, striking in the average a compromise in the middle line between claims on the one hand and the concessions of the employers on the other. This naturally led the unions to raise excessive claims, using the simple formula of doubling their actual demands. The renewal of a wages agreement without a rise in wages has become almost inconceivable. The workmen are quite sure to gain their object and no union could dare, even if it wanted, to let such opportunities pass, without making the most out of them. The negotiations between the funtionaries of both parties, prescribed by regulations have become a mere farce. It is quite sure from the beginning that a public arbitrator will have to take the

matter into his hands and decide the conflict by a compromise.

This is the reason why wages have moved constantly upward in the last four years. The sinister side of it is that cost of living shows a parallel movement. A point of difference arises therefrom, which divides Germany into two opposing camps and on which an agreement can hardly ever be expected. The labor side maintains that the wages movement is merely following the rising cost of living and that it constitutes nothing but an adjustment to the latter, while the employers argue that the increase in the cost of living is a consequence of rising wages. However that may be, it is a fact that since 1924 prices and wages are chasing each other in an almost unbroken viscious circle. That the workers' unions will cease trying to "squeeze" the employers at the rare opportunities which labor legislation offers, is out of the question and that the government through its organ will stop the unions is looked upon with almost equal hopelessness. For this reason the iron masters and machine builders of the northwestern part of Rhineland and Westphalia, usually called the Ruhr district, have literally taken the law into their own hands, for the lock-out, which they have resorted to, is unlawful, no due notice having been given of their intention six months hence.

The actual cause of the lock-out is comparatively insignificant, a rise in wages of from 4 to 5 per cent, which no doubt the majority of works could have borne with no great difficulty. What the manufacturers of the Ruhr, and with them those of the rest of Germany, really want is to put an end to governmental interference in labor conflicts and generally speaking in all concerns, which before the war were considered private matters as between employer and employed. That the owners of the Ruhr are the first to open the attack is no mere accident. They represent the strongest and, at the same time, the most headstrong section of German industry and may be trusted to gain their object in the course of time.

Machinery Exports Show Large Gain

United States exports of strictly industrial machinery during October were valued at $18,665,000—a gain of 20 per cent over the corresponding month in 1927 and nearly 40 per cent over September, 1928. Foreign shipments for the ten months totaled $170,000,000, representing a gain of almost $19,000,000 over the same period last year. Exports of metal-working machinery have been expanding steadily throughout the present year, the shipments for October and for the 10-month period being both more than 35 per cent above the corresponding figures for 1927. Construction machinery also showed an upward trend, and the exportation of conveying machinery has been on the increase.

Business Items

The Coffin Valve Co. is now located in a new office and plant at the Victory Terminal, Squantum, Mass. The mailing address is Atlantic, Massachusetts.

The Independent Pneumatic Tool Co., Chicago, manufacturer of "Thor" tools, will add 36,000 sq.ft. of floor space to its factory in Aurora, Illinois.

The Reading Chain and Block Corporation, of Reading, Pa., has changed its New York City office from 11 Park Row to 30 Church Street, where larger space has been secured.

The Porter-Cable Machine Co., Syracuse, N. Y., has appointed Knickerbocker, Cram & Co., 7 East 42nd St., New York, N. Y., as agents in the New York territory for the company's line of production and tool room lathes.

The Cutler-Hammer Manufacturing Co., of Milwaukee, will move its Atlanta (Ga.) office into new quarters at 150 Peters St., where warehouse facilities will permit carrying standard devices in stock. A. C. Gibson is manager of this office.

The capacity of the Toledo plant of the Doehler Die Casting Co. will be enlarged 25 per cent by a new unit of 10,000 sq.ft. floor space which will be in operation this week. The plant has been operating at capacity for some time.

The Western Electric Co., Chicago, will issue 250,000 no-par common shares. The $10,000,000 to be received in the sale of this stock will be used to provide additional manufacturing capacity at the Hawthorne Works and the Kearney Works, and to partly defray cost of a plant to be erected during 1929 at Point Breeze, Baltimore.

The Ingersoll-Rand Co., New York, recently declared a special extra dividend of $1 on the common and the regular semi-annual dividend of $3 on the preferred stock. On October 31, directors declared an extra dividend of $1 on the common stock.

The Saginaw Stamping & Tool Co., of Saginaw, Mich., has appointed Manning, Maxwell & Moore, Inc., New York, N. Y., distributers of its product in the New York territory. The company recently tripled its manufacturing facilities on industrial truck castors, conveyor equipment and trucks, and has added about 36,000 sq.ft. of floor space.

The Commercial Investment Trust Corporation, 1 Park Ave., New York, N. Y., announces a contract with the Westinghouse Electric & Manufacturing Co. under which the investment concern will extend the financing facilities heretofore provided by the Westinghouse Acceptance Corporation, a finance subsidiary of the Westinghouse company.

Negotiations have been in progress for several months by the Foote Bros. Gear & Machine Co., Chicago, to purchase the Lyle Culvert and Road Equipment Co., the Stockland Road Machine Co., and the Northwestern Steel & Iron Corporation, all of Minneapolis; and the Bates Manufacturing Co., of Joliet, Ill. The stockholders of the Foote company are now voting on the proposal, together with some changes in the financial structure necessary for the purchase.

Permanent discontinuance of the manufacture of the Velie automobile has been announced by W. L. Velie, Jr., vice-president of the Velie Motors Corporation, Moline, Ill. Mr. Velie, Jr., who heads the Mono-Aircraft Corporation of Moline, which is using a part of the motor company factory for building of airplanes and aeroplane engines, stated that he would center his future manufacturing activities in the airplane industry. Negotiations are under way for the sale of the Velie plants to another automobile company.

Contracts totaling more than $750,000 have been let for reconstruction work at Picatinny arsenal, wrecked in July, 1926, when lightning struck the adjoining naval arsenal at Lake Denmark, N. J. The largest part of the reconstruction project is for 21 buildings to be used for the loading of shells with TNT and the assembling and packing of complete rounds of ammunition. For laboratory work thirteen buildings will be erected, including a main laboratory, research laboratories and storage buildings.

Acquisition of the control of the Chandler-Cleveland Motor Corporation by the Hupp Motor Car Corporation has been acknowledged by officials of the latter concern, but no details of the purchase have been announced. The present market value of the combined securities of the two companies is about $135,000,000, and the combined production of the two plants will approach 100,000 units this year.

Directors of the Rome (N. Y.) Brass and Copper Co. have approved a plan to merge with five other companies to form a corporation to be known as the General Brass Corporation. Under present plans each of the constituent companies will be represented on the Executive Committee of the corporation. Factories of the individual companies will continue operation, with the management unchanged. The companies with which the Rome concern is merging are Taunton-New Bedford Copper Co., Taunton and New Bedford, Mass.; the Baltimore Sheet Mill of the General Cable Co., the Rome Manufacturing Cable Co., the Michigan Brass and Copper Co., of Detroit and the Dallas Brass and Copper Co., Chicago.

Personals

GEORGE E. JOHNSON has been appointed general sales manager of the Saginaw Stamping & Tool Co., Saginaw, Michigan.

J. A. CALLAHAN has resigned as vice-president and general manager of the Martin-Parry Corporation, to become factory manager of the Curtis Aeroplane & Motor Co., Inc., Buffalo.

Obituaries

T. H. DESSEZ, 49, manager of the Cincinnati office of S K F Industries, Inc., died at his home in Cincinnati on Dec. 2 from an attack of pneumonia. He had been with the S K F concern for the past fourteen years.

FRANCIS MARION KING, SR., president of the North Wales Machine Co., Inc., North Wales, Pa., and treasurer and manager of the Challenge Machine Co., died at his residence in Philadelphia on Nov. 20 at the age of 82. He is survived by his wife, a daughter and two sons, J. Woodruff King and F. M. King, Jr., both of whom are associated in these businesses.

GEORGE ARTHUR STEPHENS, president of the former Moline Plow Co., of Moline, Ill., died Nov. 20 in New York City, at the age of 77 years, after a brief illness. Mr. Stephens was once secretary of the plow company, later vice-president and upon the death of his father, George Stephens, succeeded to the presidency, serving from 1902 to 1918. The company was later taken over by the International Harvester Company.

Forthcoming Meetings

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

Power Transmission Association. Annual meeting, Hotel Commodore, New York City, Dec. 6. Association headquarters, 644 Drexel Bldg., Philadelphia.

Western Metal Congress and Western States Metal & Machinery Exposition. Held in Los Angeles, Jan. 14-18, under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

The Weekly Price Guide

Rise and Fall of the Market

STEEL, the most important single material in the metal working trades, bids fair to close the year at a price approximately 10c. per 100 lb. above that obtaining at the start. Shapes, plates and bars, base, Pittsburgh, are $1.90 per 100 lb., in large mill lots. This price has held since Oct. 1. Steel buying is on the up-trend in railway, oil field and agricultural implement material, while demand is tapering off seasonally in automotive and construction requirements. Copper is another important material to show a strong price position. Stocks of refined metal are down to 51,000 tons for the Western Hemisphere. This is the lowest reserve on record and prices may, accordingly, move upward.

(All prices as of Nov. 30, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55@2.65	3.60	3.30	4.00
No. 22	2.70@2.80	3.75	3.45	4.15
No. 24	2.75@2.85	3.80	3.50	4.20
No. 26	2.85@2.95	3.90	3.60	4.30
No. 28	3.00@3.10	4.05	3.75	4.45
Galvanized				
No. 10	2.70@2.80	3.95	3.65	4.25
Nos. 12 to 14	2.80@2.90	4.05	3.75	4.35
No. 16	2.90@3.00	4.15	3.85	4.45
No. 18	3.05@3.15	4.30	4.00	4.60
No. 20	3.20@3.30	4.45	4.20	4.75
No. 22	3.25@3.35	4.50	4.25	4.80
No. 24	3.50@3.60	4.65	4.35	4.95
No. 26	3.65@3.75	4.90	4.60	5.20
No. 28	3.90@4.00	5.15	4.85	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follow

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness Decimal	B.w.g. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, ¾@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.75
Tin, Straits, pigs, New York			53.00
Lead, pigs, E. St. Louis	6.25	New York	7.75
Zinc, slabs, E. St. Louis	6.35	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.50	14.00	14.25
Copper sheets, base	25.00	25.00	25.00
Copper wire, base	21.62½	21.25	17.87½*
Copper bars, base	23.50	23.50	24.00
Copper tubing, base	26.37½	26.37½	26.37½
Brass sheets, high, base	20.50	20.50	20.50
Brass tubing, high, base	25.37½	25.37½	25.37½
Brass rods, high, base	18.25	18.25	18.25
Brass wire, high, base	21.00	21.00	21.00

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.00	10.11
Solder (½ and ½)	35.75	33.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			69.25
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25

Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:
Ingots..... 35.00 Electrolytic.. 37.00 Shot..... 36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled nickel rods, Grade "A" (base)	45.00
Cold drawn nickel rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper	14.00 @14.25	13.75	12.75@13.25
Copper, heavy, and wire	13.25 @14.00	13.00	12.12½@12.50
Copper, light, and bottoms	11.75 @12.25	11.00	11.00@11.50
Heavy lead	5.00 @ 5.25	6.25	4.75@ 5.25
Tea lead	3.37½@ 3.87½	4.25	3.75@ 4.25
Brass, heavy, yellow	7.75 @ 8.00	8.50	8.00@ 8.50
Brass, heavy, red	10.75 @11.25	...	10.25@10.75
Brass, light	6.25 @ 6.75	6.75	6.75@ 7.25
No. 1 yellow rod turnings	9.00 @ 9.50	9.50	8.75@ 9.25
Zinc	3.25 @ 3.50	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.16@ .16½	38.00 per M	.17
Sal soda, per lb	.02	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	112	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	50%	50–10%	50%
Second grade	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.1825	.175	.16
Solder (½ and ½)	per lb.	.3575	.345(	.3575
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No 1, 6-in. dia	per 100	3.59	3.59	3.10
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.30	.30	.27
Belting, leather, medium	off list	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.05	$4.29	$4.29
Emery cloth	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth	3.59	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.85@3.00		
Coke, prompt foundry, per net ton	Connellsville, 4.00@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.25	
Red lead, dry	100 lb. kegs	New York, 13.25	
Red lead, in oil	100 lb. kegs	New York, 14.75	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅛-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., Mare Island—Bureau of Yards & Docks, Navy Dept., Washington, D. C.—will receive bids until Jan. 2, for hammerhead crane, here.

Calif., San Diego — Bureau of Yards & Docks, Navy Dpt., Washington, D. C.—10 ton electric bridge crane 114 ft. 1½ in. span at Naval Operating Base (Air Station) here.

Mich., Detroit—Federal Motor Truck Co., 5780 Federal Ave.—truck assembly equipment for proposed 2 story, 60 x 400 ft. factory on Federal Ave. Estimated cost $250,000.

Mich., Detroit — Linderme Machine Works, 916 Vermont St., T. G. Linderme, Purch. Agt.—shaper.

Mich., Detroit—Zenith Detroit Corp., Ft. Hart Ave.—light machine shop equipment for proposed 2 story, 60 x 120 ft. carburetor factory. Estimated cost $50,000.

Mich., Ionia—Hayes Ionia Co.—metal stamping equipment and conveyor for proposed 1 and 3 story automobile body plant. Estimated cost $180,000.

Minn., Minneapolis — Pioneer Gravel Equipment Mfg. Co., E. E. Ellertson Pres., 2005 University Ave. S. E.—traveling crane for proposed 1 story, 180 x 200 ft. factory. Estimated cost $60,000.

O., Euclid (Br. Cleveland)—Chase Brass & Copper Co., Waterbury, Conn., C. E. Hart, Jr., Secy.—three 10 ton cranes for proposed 1 story, 225 x 100 ft. factory. Estimated cost $1,250,000.

O., Toledo — Dart Boat Co. — machinery and equipment for boat manufacturing for proposed 1 story, 60 x 300 ft. factory. Estimated cost $50,000.

W. Va., Wierton — Wierton Steel Co. — overhead electric crane and open hearth changing machine.

Ont., Hamilton — Canadian Drawn Steel Co., H. J. Waddie, Mgr., 59 Gerrard St.—equipment for the manufacture of steel shafting and keys for proposed 1 story, 60 x 90 ft. addition to factory. Estimated cost $40,000.

Ont., Walkerville—Chrysler Motor Co.—machinery and equipment for manufacturing and assembling automobiles for proposed 3 story, 380 x 1,000 ft. motor factory at Tecumseh Rd. and McDougall Ave. Estimated cost $1,500,000.

Ont., Windsor — Swedish Crucible Steel Co., McDougall St., N. Olson, Mgr.—machinery and equipment for proposed addition to plant. Estimated cost $50,000.

Que., Chicoutimi—E. Tremblay, Riviere du Moulin—complete saw mill equipment for proposed sawmill here. $75,000.

Opportunities for Future Business

Ill., Chicago — Pines Winterfronts Co., J. F. Raleigh, Pres., 408 North Sacramento Blvd., plans the construction of a 2 story plant for the manufacture of winterfronts for automobiles. Estimated cost $1,000,000. Architect not selected.

Ill., Chicago — Ludlow Typograph Co., 2040 Clybourn Ave., manufacturers of typecasting machines, awarded contract for a 4 story, 64 x 135 ft. factory at 2048-54 Clybourn Ave. Estimated cost $135,000.

Ill., Chicago—Skilsaw Inc., 3814 Ravenswood Ave., manufacturers of electric hand saws, awarded contract for a 1 story factory at Elston and School Sts.

Ill., Moline—Frank Foundries Corp., 125 21st St., awarded contract for a 1 story, 100 x 160 ft. foundry and 1 story, 70 x 100 ft. shipping building. Estimated cost $100,000.

Ill., Rock Falls—Russell Burdsall Ward Nut & Bolt Co., awarded contract for a 1 story factory. Estimated cost $40,000.

Ind., South Bend — F. Wolf will soon award contract for the construction of a shop Division St. Estimated cost $40,000. C. E. Miller, Archt.

Ind., Valparaiso—Firbroc Insulating Co., is having plans prepared for the construction of a 1 story, 112 x 350 ft. factory, etc. Estimated cost $100,000. Lockhart & Fett, 457 Associates Bldg., Archts.

Ia., Cedar Falls—Banner Brass Foundry, C. W. Olsen, Mgr., 1807 Washington St., plans the construction of a 1 story, 40 x 100 ft. brass foundry.

Ia., Dubuque — Metz Mfg. Co., Elm St. and Second Ave., manufacturers of sash, doors and millwork, will soon award contract for addition to plant. Estimated cost $60,000.

Ia., Sioux City—Benson Furniture Co., I. Benson, Mgr., 1911 East 4th St., awarded contract for a 5 story, 40 x 80 ft. furniture factory. Estimated cost $40,000.

Ia., Marshalltown—Central Foundry Co., W. B. Wood and J. M. Glen, Props., plans to rebuild a 1 story, 110 x 205 ft. foundry to replace fire loss. Estimated cost $100,000.

Ia., Marshalltown—Stark Co., will soon receive bids for a 1 story, 116 x 204 ft. foundry. Estimated cost $50,000. H. E. Reimer, Kibbey Bldg., Archt.

Mass., Cambridge (Boston P. O.)—Bd. of Education, is receiving bids for the construction of a 3 story, 80 x 200 ft. school including manual training department, etc. Estimated cost $650,000. C. R. Greco, 11 Beacon St., Boston, Archt.

Mich., Ann Arbor—Machine Specialty Co., E. O. Wenk, Pres., 1200 North Main St., awarded contract for the construction of a machine shop on Main St. Estimated cost $25,000.

Mich., Detroit — Ajax Bolt & Nut Co., 6623 Gratiot Ave., awarded contract for a 2 story bolt and nut factory. Estimated cost $40,000.

Mich., Iron River — Chicago & Northwestern Ry. Co., West Jackson and Franklin Sts., Chicago, Ill., plans the construction of a roundhouse, machine shop, etc., here. Estimated cost $150,000. W. J. Towne, Ch. Engr.

Minn., Duluth—Diamond Calk & Horseshoe Co., O. Swanstrom, Pres., 4630 Grand Ave., awarded contract for a 3 story, 104 x 144 ft. addition to factory. Estimated cost $50,000. Noted Aug. 16.

Minn., Hopkins—Minneapolis Threshing Machine Co., awarded contract for a 1 story addition to foundry and factory. Estimated cost $95,000.

Minn., Minneapolis — Grau-Curtis Co., 613 First Ave. N. E., had plans prepared for a 2 story, 137 x 144 ft. factory on First Ave. N. E. Estimated cost $100,000. Lang, Raugland & Lewis, 412 Essex Bldg., Archts.

Minn., Minneapolis — O. B. McClintock Co., O. B. McClintock, Pres., 139 Lyndale Ave. N., manufacturers of burglar and fire alarm systems and chimes, awarded contract for a 2 story, 40 x 110 ft. factory. Estimated cost $60,000.

Minn., St. Paul — Donaldson Co. Inc., F. A. Donaldson, Pres., 693 Raymond Ave., manufacturers of sheet metal products, is receiving bids for the construction of a 1 story, 55 x 100 ft. addition to factory. Dorr & Dorr, 1645 Hennepin Ave., Minneapolis, Archts.

Minn., St. Paul—Watkins Mfg. Co., E. A. Watkins, Pres., Wichita, Kan., manufacturers of aeroplanes, plans the construction of a factory near St. Paul municipal airport, here.

Mo., St. Louis — Owner, c/o I. T. Cook Co., Arcade Bldg., is having plans prepared for a 1 story, 160 x 200 ft. truck body plant at Forest Park Blvd. and Sarah St. Estimated cost $80,000. Preston J. Bradshaw, 78 Locust St., Archt. St. Louis Body & Equipment Co., lessee.

Mont., Great Falls — International Harvester Co., W. D. Price, Supt. of Constr., 606 South Michigan Ave., Chicago, Ill., will soon award contract for a 3 story, 127 x 335 ft. plant here, also awarded contract for a 1 story, 112 x 229 ft. service station and warehouse at Sioux Falls, S. D. Estimated cost $150,000.

N. Y., Brooklyn — Lawton-Stevens Co., Marcy Ave. and Walton St., plans the construction of a 1 story, 75 x 100 ft. machine shop at Lorimer and East Marcy Aves. Estimated cost $25,000. C. Salenger, 1946 Freeman St., Archt.

O., Canton—Timken Roller Bearing Co., Dueber Ave., N.W., awarded contract for a 1 story, 100 x 150 ft. assembly building, etc., also 1 story, 100 x 320 ft. factory on Harrison Ave. S.W. Estimated cost $50,000 each. Noted Sept. 6.

O., Cleveland — Great Lakes Aircraft Corp., c/o C. F. Van Sicklen, 16800 St. Clair Ave., plans addition to factory. Estimated cost $40,000. Private plans.

O., Cleveland—National Lamp Works, of General Electric Co., Nela Park, awarded contract for a 1 story, 80 x 100 ft. addition to factory. Estimated cost $40,000.

O., Cleveland — State Dept. of Welfare, J. E. Harper, Dir., Columbus, will soon award contract for a 1 story, 105 x 125 ft. industrial building at State Hospital, here. H. B. Briggs, Hartman Hotel Bldg., Columbus, Archt.

O., Euclid (br. Cleveland) — The Geometric Stamping Co., D. R. Jones, Pres., 221 East 131st St., Cleveland, awarded contract for a 1 story, 250 x 600 ft. factory on Chardon Rd., here. Estimated cost $600,000.

O., Wooster — McIntosh Hemphill Co., Oliver Bldg., Pittsburgh, Pa., manufacturers of rolling mill machinery, etc., awarded contract for a 1 story addition to plant, here. Estimated cost $250,000. Noted Nov. 8.

Okla., Oklahoma City—A. & B. Spring Co., 719 West Main St., is having plans prepared for a 1 story, 75 x 140 ft. factory on 10th St. Estimated cost $60,000. Architect not selected.

Pa., Ambridge—Standard Seamless Tube Co., is having plans prepared for a 1 story addition to tube mill. Estimated cost $500,000. Private plans.

Pa., Wilkinsburg—U. S. Chromium Corp., Pittsburgh, awarded contract for a 1 story, 72 x 100 ft. factory at Pitt and Wallace Sts., here. Estimated cost $40,000.

Wash., Seattle — Issacson Iron Works, 2917 East Marginal Way, plans 70 x 240 ft. addition to works at 2917 East Marginal Way. Estimated cost $100,000.

Wis., Milwaukee — Milwaukee Foundry Equipment Co., 284 7th Ave., awarded contract for a 2 story, 70 x 129 ft. factory on South Pierce St.

Wis., Randolph — Randolph Furniture Mfg. Co., awarded contract for the construction of a 1 story, 102 x 122 ft. furniture factory.

Wis., West Allis — Allis-Chalmers Co., awarded contract for a 1 story, 100 x 200 ft. foundry and 1 story, 200 x 600 ft. tractor building, etc. on Greenfield St.

Ont., Walkerville—School Board, Equity Chambers, awarded contract for the construction of a 2 story school including manual training departments, etc. on Lens Ave. Estimated cost $250,000. Nichols, Sheppard & Masson, Windsor, Archts.

Ont., Windsor — Chrysler Corp. of Canada, J. D. Mansfield, Mgr., awarded contract for first unit of 5 story, 280 x 1,000 ft. factory. Estimated cost $1,500,000. Noted Nov. 22.